

SOUTHEASTERN BIOLOGY

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ASB ASB 67TH ANNUAL MEETING ASB

GATLINBURG, TENNESSEE

MARCH 29-APRIL 1, 2006

ASB

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*Appalachian Challenge of the Future—
preserve, protect and educate*

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The University of Tennessee, Knoxville

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See Page 67 and Consult Website
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Painted trillium, *Trillium undulatum*, Great Smoky Mountains National Park.

Photo by A. S. Heilman, University of Tennessee, Knoxville.

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*The Official Publication of
The Association of Southeastern Biologists*

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SOUTHEASTERN BIOLOGY

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PURPOSE

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

2006 March 29-31, April 1: Hosted by the University of Tennessee, Knoxville, Tennessee.
2007 April 18-21: Hosted by the University of South Carolina, Columbia, South Carolina.
2008 April 16-19: Hosted by Furman University, Greenville, South Carolina.

A MESSAGE FROM THE PRESIDENT

DWAYNE WISE

January 2006

I believe that we can all agree that this has been a productive year for ASB. We have seen some changes and we continue to wrestle with even more change. I firmly believe that any organization must embrace change and must adapt to new circumstances. As I have worked with the Executive Committee this past year, I have been most impressed with the hard work and dedication of this group. I can say the same for our several committees. I have encountered nothing but willingness to help and selfless dedication to the health of our society. I am most grateful to all of you and to the many members who have offered support.

ASB, in my opinion, faces some challenges as a consequence of its own success! We have grown to a size such that our meetings no longer fit comfortably on college campuses. We have engaged the services of a professional meeting planner. Local Organizing Committees have seen much relief from this, since arranging for a larger meeting has grown to be an ever more onerous task. I don't believe we can seriously ask faculty to donate a year of their professional lives to plan the annual meeting. That being said, I am also convinced that ASB, and in particular the Executive Committee, must keep firm control of the annual meeting planning. These are issues that we will confront for the next few years and I am confident that, as usual, the ASB membership and leadership will find reasonable solutions.

ASB is the largest regional biology society in the country. Therefore, we have several affiliates who contribute in immeasurable ways to the life of ASB. This year we welcome a new affiliate, the Southeastern Electron Microscopy Society. SEEMS will bring new members with diverse interests. This can only bode well for ASB. In addition, I have been approached by other organizations about possible affiliation. I believe we have good opportunities to enrich our society through affiliations.

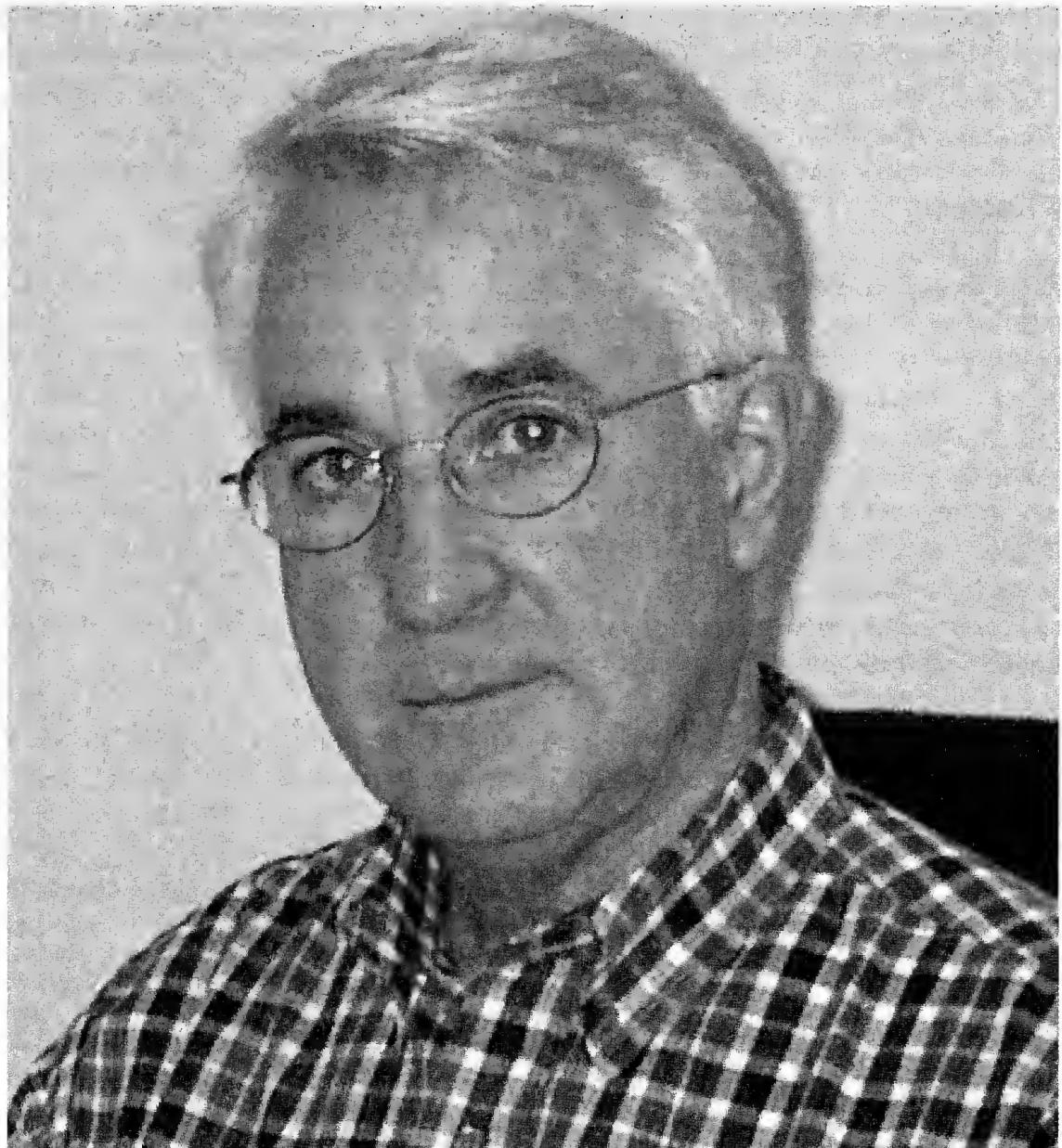
Growth brings challenges, but it also brings prosperity, both financial and scientific. We will have more exhibitors at the Gatlinburg meeting than we have had in quite some time. Please visit with our exhibitors and let them know that they are important to us. New ASB members bring with them their biological interests. In an era in which the gut contents of mites can be subjected to molecular techniques such as polymerase chain reaction in order to tell the ecologist what prey have been eaten by the mite, collaboration is more important than ever. None of us has all the answers to how we should approach our own research and teaching.

I will not attempt to detail all the items of progress that have been made this year (new awards, new life members, contributions to the enrichment fund, dedicated service of officers, committees and members...and the list goes on).

Rather, I wanted to use this space to make a few statements of what I think are facts. Most especially, I want to sincerely thank all the people who have helped me during my stay as President. I have been humbled by your willingness to serve ASB without reward or recognition. I hope I have been worthy of the help.

I look forward to seeing all of you in Gatlinburg on March 29. I believe you will not be disappointed by this year's annual meeting.

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Dwayne A. Wise, ASB President

ASB CANDIDATES FOR OFFICE—2006

The Nominating Committee composed of Andrew N. Ash (Chair), Patricia Parr, and Eloise Carter has selected the following slate of nominees for the ASB offices to be filled in 2006. Voting will take place at the annual business meeting at 11:15 A.M. on Friday, March 31, 2006. Additional nominations will be accepted from the floor before voting is conducted. Please plan to attend and vote. Elections can sometimes be close. Therefore, your vote could make a difference on who gets elected to office.

<i>President-Elect</i>	Beverly Collins	Savannah River Ecology Lab Aiken, South Carolina
	W. Michael Dennis	Breedlove, Dennis & Associates Orlando, Florida
<i>Vice-President</i>	George Cline	Jacksonville State University Jacksonville, Alabama
	Bonnie Kelley	University of North Carolina Pembroke, North Carolina
<i>Secretary</i>	Debbie Moore	Troy University Dothan, Alabama
	Paul A. Schmalzer	Dynamac Corporation Kennedy Space Center, Florida
<i>Executive Committee</i>	Neil Billington	Troy University Troy, Alabama
	Mijitaba Hamissou	Jacksonville State University Jacksonville, Alabama
	Donald H. Roush	University of North Alabama Florence, Alabama
	Robert Wayne Van Devender	Appalachian State University Boone, North Carolina



Beverly Collins



W. Michael Dennis



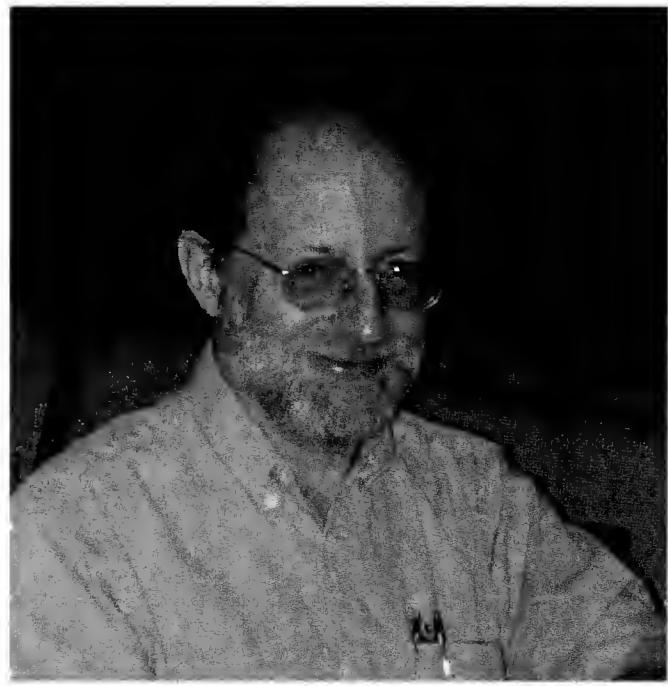
George Cline



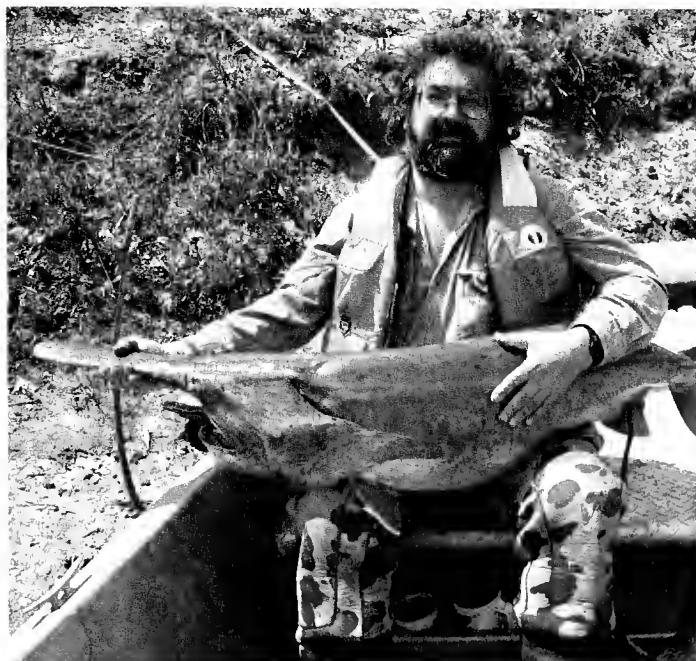
Bonnie Kelley



Debbie Moore



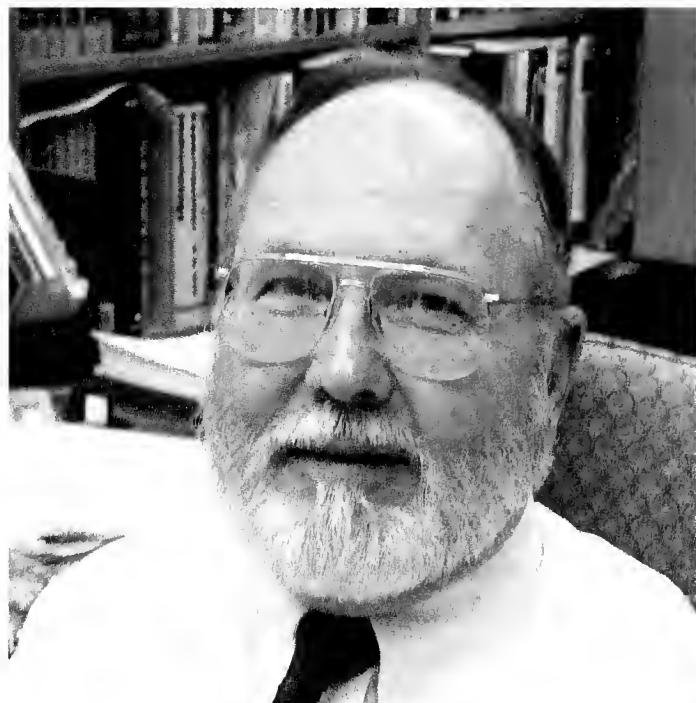
Paul A. Schmalzer



Neil Billington



Mijitaba Hamissou



Donald H. Roush



Robert Wayne Van Devender

PRESIDENT-ELECT

Beverly Collins – Dr. Collins is an Associate Research Ecologist at the University of Georgia's Savannah River Ecology Laboratory (SREL). She received her undergraduate degree in Botany from the University of Kentucky, and her M.S. and Ph.D. degrees in Botany and Plant Physiology from Rutgers University. She held a postdoctoral appointment at SREL and was an Assistant Professor of Biology at the University of Memphis before returning to SREL in 1994. She will be moving to Western Carolina University in fall, 2006, to become an Associate Professor of Biology. There, she will teach and pursue her research interests in plant community ecology and biodiversity. Having grown up in the mixed-mesophytic forest of east Kentucky, she is intrigued by environmental variation and disturbance effects on plant community composition, structure, and dynamics. Past research has examined the dynamics of forest, Carolina bay, and sandhills communities.

Beverly has been a member of ASB since her return to the southeast. She has served ASB as Secretary and on the Committee for Women, Minorities, and the Disabled. She also has served as Editor-in-Chief of the Journal of the Torrey Botanical Society, guest editor for a Natural Areas Journal theme issue of rare plants of the southeastern U.S., and Associate Editor for the Journal of Vegetation Science. She helped establish a local charter high school, and currently serves on the curriculum committee of the school improvement council. In her spare time, she practices taekwondo, weaving, and the piano, and observes the southern mixed pine-hardwood forest outside her back door.

W. Michael Dennis – Dr. Dennis is a native Georgian, born and raised in the rural Piedmont southeast of Atlanta. He grew up with an interest in science and biology in particular. His first baccalaureate education came by way of an A.A. degree from Oxford College of Emory University followed by a B.S. degree from Emory. The United States Army then required his services for about two years. After being honorably discharged, he attended the University of South Carolina where he fell under the influence of Dr. Wade T. Batson which led to a M.S. degree awarded for his research on the ecology and vegetation of the Santee Swamp. He then left the Piedmont and coastal plain of South Carolina for the Appalachian Mountains and Ridge and Valley of east Tennessee where he completed his doctorate degree on the Viorna group of *Clematis*. Dr. Dennis' professional career began with the Tennessee Valley Authority where for 5 years he studied the valley's rivers, streams and wetlands. For the past 25 years he has been a practicing environmental consultant and is the President of Breedlove, Dennis and Associates, Inc. Dr. Dennis has also served as a visiting professor at the University of Tennessee and the University of North Alabama. BDA is a patron member of ASB, and Dr. Dennis is a life member of ASB and has been a member for 34 years serving in various capacities including as Chairman of the Enrichment Committee and Member at Large of the Executive Committee.

VICE-PRESIDENT

George R. Cline – Dr. Cline, the 2004 Outstanding Faculty/Staff member at JSU, is a professor of biology in the College of Arts and Sciences. He has taught at JSU since 1992. He holds a bachelor's degree from Indiana University of Pennsylvania in Indiana, Pennsylvania, with double majors in biology and environmental health, which he earned in 1974. He holds a doctorate from Oklahoma State University in Stillwater, Oklahoma. He is a member of the Chancel Choir at First United Methodist Church in Jacksonville and assists with the children's choir and music committee. He volunteers as a soccer and t-ball coach with Jacksonville's Parks and Recreation Department, volunteers to present programs for the Girl Scouts of Cottaquilla Council, and Kitty Stone Elementary School. He helped establish the Alabama Herpetological Society and the annual College of Arts and Sciences Research Symposium. He is from Derry, Pennsylvania, and is married and has two small children.

Bonnie Kelley – Dr. Kelley is a Professor of Biology at the University of North Carolina at Pembroke. She received her undergraduate degree in Biology at North Georgia College, her Masters in Science Education and her Doctorate in Plant Pathology from the University of Georgia. She has been a member of ASB for sixteen years and has served on the Executive Committee, the Meritorious Teaching Award Committee, the Committee on Women, Minorities, and Persons with Disabilities (two terms), the Publications Committee, and the Auditing Committee, chairing each of those in the third year of the term. As Chair of the Committee on Women, Minorities, and Persons with Disabilities she planned and facilitated a symposium at the Annual Meeting for each of those years. She was Chair of Publications the year ASB decided to Co-sponsor the Southeastern Naturalist leading an extensive discussion with the extended committee members before a recommendation went to the Executive Committee. Dr. Kelley has served as AAAS Representative for ASB for several years. She has only missed the Annual Meeting once since joining ASB (unavoidable conflict) and serves as the official Thursday Night Social dance coordinator.

SECRETARY

Debbie Moore – Dr. Moore is an associate professor of biology in the Department of Natural Sciences at the Troy University Dothan Campus in Dothan, Alabama. After working as a RN for several years she returned to academia and received her B.S. in Biology (1992) and her Ph.D. (1997) working with Ken Marion at the University of Alabama Birmingham. Her dissertation research involved molecular analyses of temperate hylid frogs using the mitochondrial cytochrome b gene. She currently teaches general studies biology as well as a variety of upper division and graduate level courses including Field Ecology, Limnology, Local Flora and Comparative Vertebrate Anatomy. She serves as the advisor for the preprofessional students as well as the biology secondary education students at TSUD. She serves on numerous department, college and university committees and chairs the General Studies Committee. She continues a program to involve prospective teachers (and their classes) in amphibian monitoring programs. Her research interests include amphibian recruitment in ephemeral ponds in recurring drought conditions and the effects of

sedimentation on larval success. Currently she is involved in a study of seasonal habitat usage by southeastern Chiroptera in the Wiregrass region. She has served on the ASB Education Committee and is Chair of the Publications Committee this year. She has served as the Book Review Editor for the past two years. She is a member of the Ecological Society of America, the American Society of Ichthyologists and Herpetologists, and other organizations. She has been a member and chairman of the Southeastern Chapter ESA committee for the Odum Student Award for best student paper in ecology.

Paul A. Schmalzer – Dr. Schmalzer received a B.A. in biology from Western Maryland College, (1976) and M.S. (1978) and Ph.D. (1982) in ecology from the University of Tennessee. He is a plant ecologist with the Dynamac Corporation at Kennedy Space Center, Florida. His current research interests include: effects of fire on vegetation and soils, restoration of scrub ecosystems, distribution of rare scrub plants, and composition and dynamics of barrier island plant communities. Previous research included studies of vegetation and flora of the Cumberland Plateau in Tennessee and habitat use by gopher tortoises. He has received certification as a Senior Ecologist by the Ecological Society of America. He is a member of the Ecological Society of America, Society of Wetland Scientists, Association of Southeastern Biologists, Southern Appalachian Botanical Society, and other professional societies. He served as editor for *Castanea* (2001-2004) and as Vice Chair, Secretary, and Chair of the Southeastern Chapter of the Ecological Society of America. He serves on the Environmentally Endangered Lands Selection and Management Committee for Brevard County, Florida. He is author or coauthor of 44 published papers and numerous technical reports.

EXECUTIVE COMMITTEE

Neil Billington – Dr. Billington is a Professor of Molecular Ecology at Troy University, Troy, Alabama. He received his B.Sc. in Animal and Plant Ecology (1978) and Ph.D. in Limnology (1985) from Loughborough University, England. He conducted post-doctoral research in Ontario, Canada at the University of Windsor and the University of Guelph. He held teaching appointments at Southern Illinois University at Carbondale, the University of Maine at Machias, and Shippensburg University (Pennsylvania), before joining the faculty at Troy University in 2000. At Troy, Dr. Billington teaches undergraduate classes in Principles of Biology, General Ecology, Genetics, Limnology, and Population Ecology, and graduate classes in Conservation Biology, Issues in Aquatic Ecology, Limnology, and Population Ecology. He has also taught graduate classes in Molecular Genetics Techniques, Fish Genetics, How to Write a Scientific Paper, Fisheries Seminar, and Molecular Ecology Seminar, and undergraduate classes in Aquatic Biology, General Zoology, and Evolution. Neil's research focuses on population genetics, hybridization, and molecular systematics of fishes, especially Percidae, and limnology of arctic and southeastern Alabama ponds. He received the Phi Kappa Phi Outstanding Scholar Award at Troy University in 2004. Neil joined ASB in 2000 and recently became a life member. He served on the ASB Graduate Travel Award Committee 2003-2005 (Chair in 2004-2005) and was a member of the Program Committee for ASB 2005 in Florence, AL. He was recently appointed as vice-chair of the Southeastern Chapter of the Ecological Society of America. He is

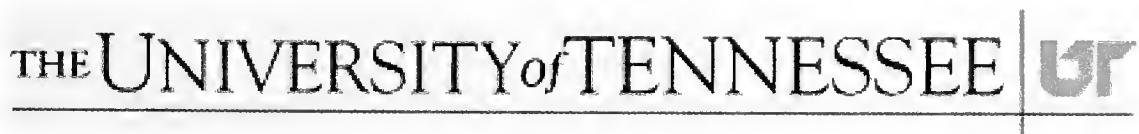
also involved with the American Fisheries Society and the British Ecological Society.

Mijitaba Hamissou – Dr. Hamissou is a native of Africa. He came to us from the sub-Saharan country of the Republic of Niger. He is currently an Assistant Professor of Biology at Jacksonville State University, Jacksonville, Alabama. He received his undergraduate in Agronomy in 1985 at Oklahoma State University and his PhD in Botany from Oklahoma State University in 1992. He then took a post-doctoral research fellowship with the USDA/ARS in Stillwater for one year before joining the Department of Microbiology and Molecular Genetics at Oklahoma State University as an Adjunct-Assistant Professor. There, he taught Cellular and Molecular Biology and Cellular Physiology for 7 years. Dr. Hamissou joined Jacksonville State University in the Fall of 2001 where he enjoys teaching introductory biology, plant anatomy and cell biology. Dr. Hamissou is a plant molecular biologist with research interest in the physiology and molecular biology of plants dysfunctional state. His biggest curiosity is how plants defend themselves against biotic and abiotic stresses. He is currently investigating the molecular responses of plants grown in metal contaminated environments as well as looking into the role of plants surface wax cover in tolerating high UVB radiation. Dr. Hamissou has been serving in the ASB Poster Judging Committee since 2002. He is also the Treasurer of the Alabama Academy of Science, member of ASB, member the Society for Environmental Toxicology and Chemistry (SETAC)

Donald H Roush – Dr. Roush is an associate professor of biology in the Department of Biology at the University of North Alabama in Florence, Alabama. His education began and concluded at the University of Mississippi with the awarding of a BS (70), MS (72), and Ph.D. (81). His experience continued with a short period at St. Jude Research Hospital in Memphis, Tennessee. His areas of interest include general microbiology and immunology. His current research interests are in microbial ecology and antibiotic resistance of organisms from environmental water systems and sewage treatment facilities. He has worked most recently with commercial consulting firms on problems of “sick building” remediation caused by fungal growth and contamination. His teaching includes courses for biology majors and allied health including nursing, physical therapists, pre-medical and pre-dental. He is a member of numerous honor societies, holding regional and national offices. Other professional organizations he is a member of and contributed to include AAUP (campus officer), American Society for Microbiology (ASM), SE Branch ASM, Mississippi Academy of Sciences, and Alabama Academy of Sciences. He has presented papers and posters as well as served as a judge at state, regional and national meetings for all of these organizations and as the delegated ASM judge to several International Science and Engineering Fairs (Westinghouse and Intel competitions). He was nominated and selected for inclusion in Who's Who Among America's Teachers for 2003-04 and 2005-06. He is a member of ASB and has attended and contributed to every meeting since 1989. He is the representative to ASB for the affiliated organization Beta Beta Beta (TriBeta, the biology honor society), which meets jointly with ASB each year. He is a regional director for the southeastern region of TriBeta and responsible for the organization of their scientific program and field trips held jointly with ASB each

year. As a result he has attended and collaborated with all the local arrangement committees and the Executive Committee of ASB since 1991. He has served ASB on numerous committees including the resolutions committee, the ad hoc committee to study electronic submission of abstracts, the ad hoc committee to study a possible advertisement policy for Southeastern Biology and the local arrangement committee for the 2005 ASB meeting in Florence, Al. In addition, he has served and is the current chair of the selection committee for the microbiology research award sponsored by Brooks/Cole.

Robert Wayne Van Devender – Dr. Van Devender was born an Air Force kid in Roswell, New Mexico in 1947 and developed an interest in lizards before his third birthday. After re-discovering amphibians and reptiles and graduating from high school outside of Dallas, Texas, he completed an undergraduate degree at Yale University in 1965. In the Yale years he developed new interests in salamanders, evolution, and photography and submitted his first scientific paper. From New Haven, he moved to Ann Arbor, Michigan, for much of the next nine years. In those years he came to love the tropics, completed a dissertation on basilisk demography in Costa Rica, as well as meeting and marrying Amy Sharader. Between finishing the dissertation in 1975 and moving to Appalachian in 1978, he taught at Oklahoma State University, supervised the computerization of the Michigan herp collection, and carried out surveys of endangered amphibians and reptiles in Michigan. After coming to Boone, North Carolina, as a lizard ecologist and discovering that not one species of lizard lives in Boone, he discovered that the beauty, diversity, and sheer abundance of salamanders was worth the relocation to the living Pleistocene here in the southern Blue Ridge. During the 27 years in Boone, he has had a dozen MS students finish projects ranging from radiotelemetry of salamanders to salamander systematics and ecology to mammal population biology to various factors related to amphibian population declines and recoveries. His students and he have attended many scientific meetings and presented many papers during those years. He has maintained an interest in photography over the years and uses images as tools in all his teaching. Using photography as an obvious excuse for searching out new and interesting subjects for the classroom has led him to amass a collection of well over 100,000 slides and a collection of over 25,000 specimens of herps and mammals at ASU. He has also served on host committees for two ASB meetings and two SSAR meetings, has been elected as a Councilor of the Herpetologist's League, has served as both President and Vice-president of the North Carolina Herpetological Society, has been a scientific advisor and representative of Appalachian State University at the Highlands Biological Station for many years, and has been nominated for President of the SSAR. He suspects that his most lasting contributions to our scientific community will be the many photographs of herps and mammals that he has been able to share over the years. He is currently working with two graduate students, with his wife on her survey of the land snails of North Carolina, and with several people on a survey of the amphibians, reptiles and even leeches of Cat Tien National Park in South Vietnam. While he has little interest in getting to his final continent (Antarctica), he certainly wants to spend a great deal more time and effort in all the other continents. So many places and creatures and so little time.



is proud to host the



67th Annual Meeting

2006 Association of Southeastern Biologists

March 29-April 1, 2006

Gatlinburg, Tennessee

Gatlinburg Convention Center & Glenstone Lodge

The University of Tennessee

The University of Tennessee, on the banks of the Tennessee River, began as Blount College, chartered on September 10, 1794. Following the Civil War, the State of Tennessee made the University the beneficiary of the Morrill Act of 1862, which allocated federal land or its monetary value to the various states for the teaching of "agricultural and mechanical" subjects and to provide military training to students. Thus, the University of Tennessee (its designation after 1879) became a land-grant institution. Today, the population on the Knoxville campus consists of approximately 25,000 students and 8,160 faculty and staff. While the University has acquired a national reputation in both men's and women's athletics, the UT Knoxville campus during its history has also produced some distinguished academics and statesmen, including one Nobel laureate, six Rhodes Scholars, five Pulitzer Prize winners, two National Book Award winners, nine U.S. Senators, and one U.S. Supreme Court justice. These alumni and an infinite number of others of less prominence bear witness to the University's success in fulfilling its mission of preparing citizens of Tennessee and the nation for their role in a democracy, helping individuals to realize their own potential, and training them to perform service for the state and the nation.

67th Annual Meeting

Appalachian Challenge of the Future—preserve, protect and educate

This four-day event brings together approximately 800 biologists from across the southeastern United States. The meeting features a distinguished plenary speaker Dr. Peter White, two special symposia (ATBI “a search for species in our own backyard” and Bioinformatic: Community standards and Research Questions), five field trips, close to 500 oral and poster presentations, seven commercial workshops, networking and social events, and more. Interests are diverse, and range from genetics and molecular biology, to physiology and population biology, to plant systematics and plant biology to community and ecosystem ecology.

About ASB

The Association of Southeastern Biologists (ASB) was established in 1937 by biologists concerned with the quality of biological research in the southeastern United States. Today, ASB is the largest regional biology association in the country, and is committed to the advancement of biology as a science by the promotion of science education, research, and the application of scientific knowledge to human problems.

Getting To Gatlinburg Is Easy

From Virginia:

Take I-81 South to I-40 East to Exit 435 (Newport) and follow Hwy 321 South all the way into Gatlinburg. Approximate drive time from interstate: 45 minutes

From Lexington:

Take I-75 South to I-640 East, then I-40 East to exit 435 (Newport) and follow Highway 321 South to Gatlinburg. Approximate drive time from interstate: 45 minutes

From Chattanooga:

Take Exit 81 on I-75 North and follow Highway 321 North through Maryville and Townsend and Highway 73 to Gatlinburg. Approximate driving time from interstate: 70 minutes.

From Nashville:

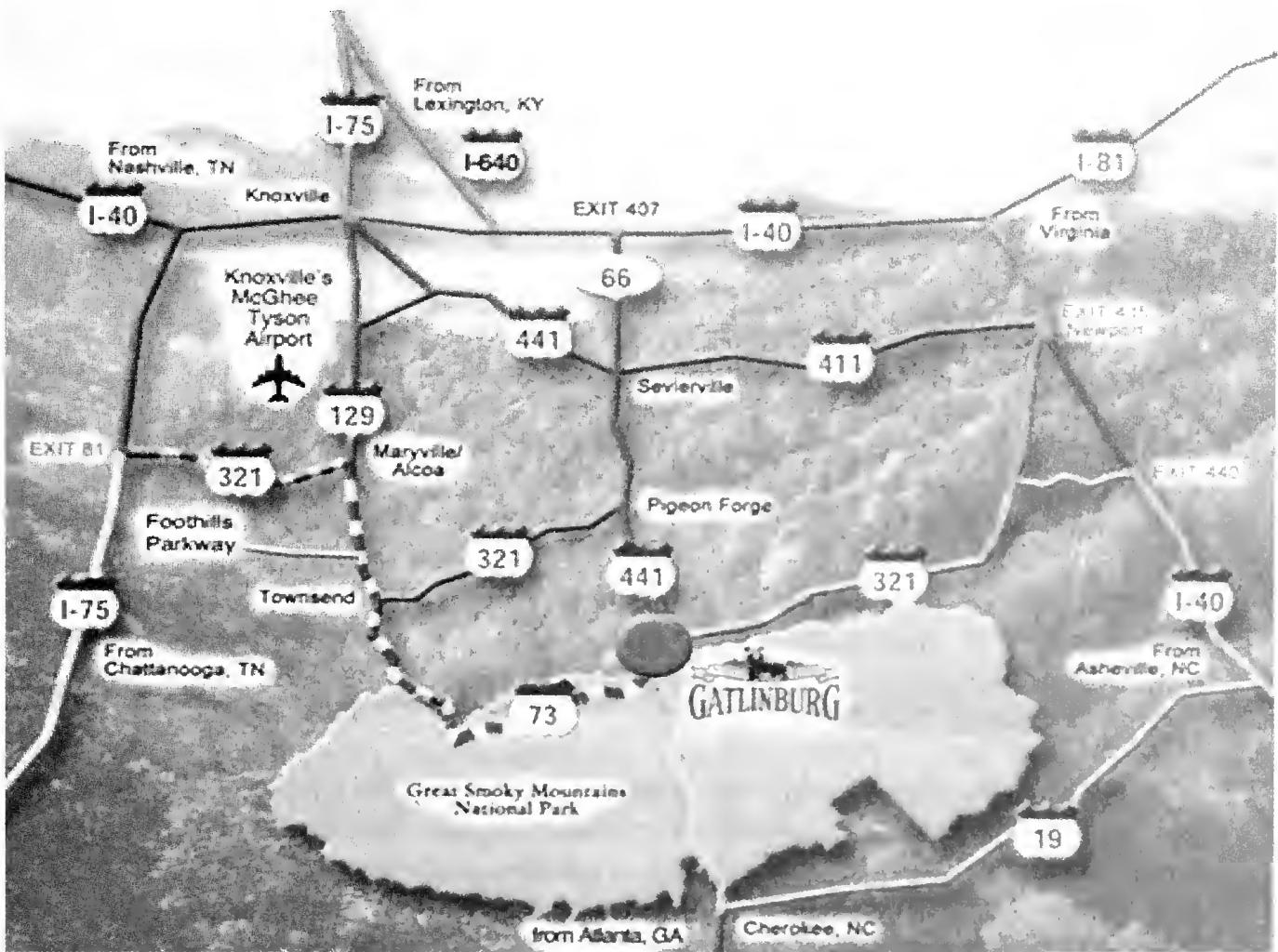
From I-40 take I-75 South to Exit 81 and follow Highway 321 North through Maryville and Townsend and Highway 73 to Gatlinburg. Approximate driving time from interstate: 70 minutes.

From Asheville:

Take I-40 West to Exit 443 and follow Foothills Parkway to Highway 321 South to Gatlinburg. Approximate drive time from interstate: 45 minutes.

From Atlanta:

Take I-85 North to I-985 North to US 23. Take US 23 to Highway 23/441 to Highway 74/441 through Cherokee, NC to Gatlinburg. Approximate drive time from Atlanta: 4 hours 10 minutes.



Directions to the Convention Center and Hotels:

The Convention Center and all the conference hotels (The Glenstone Lodge, Holiday Inn, Super 8 motel and the Microtel) are located on the Historic Nature Trail (formally Airport Rd). Turn at stoplight 8 off of U.S. Hwy 441 (The Parkway) in Gatlinburg.

ASB Field Trips

The Great Smoky Mountains National Park (GSMNP) is a national treasure whose biological richness is unsurpassed anywhere in the Eastern United States. Yet, even after 75 years of biological studies in the park a complete assessment of the species richness of all groups of organisms is still unknown. The All Taxa Biological Inventory (ATBI) was created to stimulate new efforts on inventorying the biological taxa of all the living organisms in the park. As the known number of species in the park increases there is greater interest in preservation of this diversity from some of the environmental perils which threaten the health of all the flora and fauna within. With the 2006 annual SABS meeting in Gatlinburg TN, this affords participants a great opportunity to experience one of the United Nations designated International Biosphere Reserve first hand. Therefore, we have proposed six trips focusing on major groups of organism, biological inventories and environmental issues facing the preservation of the biota.

Filed Trips begin at their specified time on **Saturday, April 1, 2006**. Trips are half day in length and will caravan (car pooling will be encouraged) from

Sugarlands Visitor Center in the Great Smoky Mountains National Park to their destination (Please note: Tri-Beta Field Trip will meet at the Aquarium entrance @1:15PM). Participants will need to be prepared for wet and or cool weather and possible wet environments. Bring water and food as needed. Cost: \$10.00. For information, contact field trip coordinators Ken McFarland (kdmcfarl@utk.edu) or Edward Clebsch (eclebsch@utk.edu) by e-mail for phone (865-974-6841).

1) Birding in the Smokies – a first hand view of the great diversity of birds in the Smokies. A number of bird habitats will be explored from Sugarlands to Cades Cove. Meet at 7:00 AM and depart promptly. Limit 15 Participants-5 cars. Bring Binoculars. Contact/ leader: Jason Mitchell, TVA Biologist (jmmitchell@tva.gov).

2) Aquatic Insects in the Smokies – With the advent of the ATBI, studies on the insect diversity of the park have increased the known number of species. Come and join one of the ATBI entomologists and learn about the insect's role in the environment. Meet at 8:00 AM. Limit 20 participants. Contact/leaders: Dr. Jim Lowe, Entomologist, professor emeritus University of Montana (jhlowejr@hotmail.com) and TVA Aquatic Biologist, Bo Baxter (jtbaaxter@tva.gov).

3) Plant Communities of the Smokies – no other place in the eastern US can you see the diversity of plant communities as those found in The Great Smoky Mountain National Park. Take a biome journey from secondary mesic forest of Sugarlands to the Spruce-Fir forest on Clingman's Dome. Meet at 8:00 AM. Limit 20 participants—7 cars. Contact/leaders: Dr. Ed Clebsch, Botanist, professor emeritus University of Tennessee (eclebsch@utk.edu), Dr. Ken McFarland, Botanist, University of Tennessee (kdmcfarl@utk.edu), and Dr. William H. Martin, Ecologist, Eastern Kentucky University (bill.martin@eku.edu).

4) Salamanders of the Smokies – The Park is considered to be the salamander capital of the world. The diverse habitats provide environments for 30 taxa, including an endemic species, ranging in size from less than 5 cm to almost 1 meter. View first hand some of this diversity and learn about their biology. Bring boots and hand lens. Meet 8:00 AM. Limit 20 participants. Contacts/leaders: Dr. Floyd Scott, Herpetologist, Austin Peay University (scott@apsu.edu) and John Byrd, Herpetologist and biologist extraordinaire (cresosnake@aol.com)

5) Black Bears and Wild Boars in the Smokies – Human interactions with the black bear in and around the boarders of the park is an ongoing problem for both organisms. Learn about bear habitat and the threats tourist and urbanization have on their environments. Similarly, the introduced wild boar has had a major impact on the native herbaceous plants in the park. Learn about there impacts on the park and the parks efforts to manage their populations. Meet at 8:00 AM. Limit 15 participants. Contact/leader: NPS Ranger, Carey Jones (carey_jones@nps.gov).

6) Tri-Beta - Ripley's Aquarium of the Smokies – wants to welcome you to America's most visited state-of-the-art, spectacular 1.4 million gallon world-class aquarium. The Aquarium not only features eleven-foot sharks, but 8,000 other exotic sea creatures from around the world. You will experience piranhas in

Tropical Rain Forest, discover colorful Indo-pacific fish in *Coral Reef*, cruise through the world's longest aquarium tunnel on a 340 foot glide-path beneath the *Shark Lagoon*, pick up a horseshoe crab in *Discovery Center*, come face-to-face with a giant octopus in *Gallery of the Seas*, touch a ray in *Touch-A-Ray Bay*. Meet at the Aquarium entrance @1:15PM. **Does not include lunch.** Additional Information please go to the link below.

<http://www.ripleysaquariumofthesmokies.com/home.htm>

NEW Commercial Workshops

All commercial workshops will be presented on Wed 3/29/06 by exhibitors at no additional charge to ASB participants. This is a new and exciting dimension of the Annual ASB Meeting. Topics range from the non-formaldehyde preservative used in dissection to the latest electron microscopy instruments. Plan to attend this year's event a day early and learn about the latest tips from the experts.

Social Events

Wednesday Night Mixer will be in the exhibitor area of the Tennessee Ball room immediately following the Plenary Session. A local bluegrass group, the "Woodpickers", will provide background music. Heavy Hors d'oeuvres and cash bar will be available.

Thursday Night Social: Beer and Bandana Bash at Mills Auditorium. "A Celebration of the Smokies". Food will be picnic style with Hamburgers and hot dogs; beer will be furnished by Smoky Mt. Brewery (microbrew). The "Kings", a popular group from Roanoke Virginia, will entertain us with their large repertoire which allows them the freedom to play whatever we would like to hear and dance to.

Friday Night Awards Banquet: Tennessee Ballroom: the menu for the banquet will be Chicken en Croute (Boneless breast of chicken stuffed with mushrooms, backed and served with a mushroom demi-glace); chef's choice of vegetables, spinach-orange salad, assorted desserts, and chocolate fountain with strawberries, pineapple, pound cake and sugar cookies. **Vegetarian meals will be available upon request.** Following dinner award presentations will be made and Past President, Claudia Jolls, will present the banquet address. **(A reminder: those competing for awards must be present at the banquet in order to receive the award).**



REGISTRATION

	Pre-Registration (Before 1 March 2006)	Late Registration (After 1 March 2006)
<input type="radio"/> ASB Regular Member	\$135.00	\$175.00
<input type="radio"/> ASB Student Member	\$ 65.00	\$ 85.00
<input type="radio"/> ASB Non-Member*	\$155.00	\$190.00
<input type="radio"/> ASB Non-Member Student*	\$ 90.00	\$120.00
<input type="radio"/> Exhibitor with no booth	\$130.00	\$195.00

* _____ Check here if you wish this to include one year membership to ASB at no additional charge

Social Events: Tickets will be available on-site

Wednesday evening Wine and Cheese, Post-plenary Session cash bar social with live entertainment

Regular Thursday night "A Celebration of the Smokies"-Beer & Bandanas \$35.00

Student Thursday night "A Celebration of the Smokies"-Beer & Bandanas \$25.00

Regular Friday evening ASB Banquet \$35.00

Student Friday evening ASB Banquet \$20.00

Thursday morning Past President's Breakfast \$15.00

SWS Thursday Luncheon \$15.00

ESA/SE Friday Chapter Luncheon \$16.00

SSP Friday Chapter Luncheon \$16.00

SABS/BSA Friday Breakfast \$13.50

SEMS Friday Breakfast \$13.50

Additional Events

Women & Minorities & People With Disabilities--Thursday Workshop
(Workshop Limited to 25 participants)

Field Trips

Birding in the Smokies	\$10.00
Aquatic Insects in the Smokies	\$10.00
Plant Communities of the Smokies	\$10.00
Salamanders of the Smokies	\$10.00
Black Bears and Boars in the Smokies	\$10.00
***Tri- Beta Field Trip (Limited to 50 Participants)	\$17.00

Note: All Field Trips will depart from the Sugarlands Visitor Center in the GSMNP.

*****Please note:** BBB Field Trip will meet at the entrance of the Aquarium @1:15PM

To view/print a Park Map, go to the link below:

(http://www.sunnydayguide.com/smoky_mountains/pdfs/maps/HikingMap.pdf)

Hotel Information

ASB has secured the following hotels at a discounted rate for exhibitors and attendees. Please remember to ask for the special ASB discounted rate when making reservations. The following hotels are providing additional services to accommodate ASB. Please make your reservations soon. The Glenstone Lodge is our Headquarters Hotel and has been secured for Exhibitors and Regular Members. The Microtel Inn is directly across the street from the entrance to the Gatlinburg Convention Center and has been designated for student housing. Over flow accommodations are with the Holiday Inn and Super 8 Motel. Please make your reservations as soon as possible. Please visit their web sites for directions to their property. **THE LAST DAY TO RESERVE A ROOM AT THE DISCOUNTED RATE IS 2/01/06.**

Headquarters Hotel

Exhibitors & Regular Members

Glenstone Lodge
504 Historic Nature Trail
Gatlinburg, TN 37738
800/362-9522
<http://www.glenstonelodge.com/>
Rates:
Single: \$75.00 Double:\$75.00
Triple: \$75.00 Quad: \$75.00

Student Housing

Microtel Inn
211 Historic Nature Trail
Gatlinburg, TN 37738
865/436-0107
<http://www.microtelinn.com/>
Rates:
Single: \$59.95 Double: \$69.95
Triple: \$69.95 Quad: \$69.95
Suite: \$79.95

Exhibitors & Regular Members

Super 8
417 Historic Nature Trail
Gatlinburg, TN 37738
866 436-2228
www.ichotelsgroup.com
Rates:
Single:\$69.95 Double: \$69.95
Triple:\$69.95 Quad: \$69.95
King Bed, Fireplace & Jacuzzi: \$89.95

Overflow Hotel

The Holiday Inn Sunspree
520 Historic Nature Trail
Gatlinburg, TN 37738
865 436-9201
www.ichotelsgroup.com
Rates:
Single:\$75.99 Double: \$75.99
Triple:\$75.99 Quad: \$75.99



2006 Association of Southeastern Biologists Commercial Workshops

NEW Commercial Workshops

All commercial workshops will be presented on Wed 3/29/06 by exhibitors at no additional charge to ASB participants. This is a new and exciting dimension of the Annual ASB Meeting. Topics range from the non-formaldehyde preservative used in dissection to the latest electron microscopy instruments. Plan to attend this year's event a day early and learn about the latest tips from the experts.

All workshops will be held in the newly renovated Gatlinburg Convention Center Note: All workshops are 45 minutes in length.

1. Comparative Vertebrate Anatomy with Carolina's Perfect Solution® Specimens

Sponsor: Carolina Biological Supply Company

Location: Tennessee Ballroom C

Time: 9:15 AM

Hands-on, inquiry-based, vertebrate anatomy, comparing/contrasting specimens to each other, and to the ultimate vertebrate, the human. Carolina's Perfect Solution® specimens are safe, no formaldehyde odor.

2. PerkinElmer's New UltraVIEW Live Cell Imaging

Sponsor: PerkinElmer Life and Analytical Sciences

Location: Tennessee Ballroom D

Time: 9:15AM

Finally, there's a live cell imager than won't damage the cells you're studying! PerkinElmer presents UltraVIEW™, real-time, high resolution confocal microscopy systems for live cell imaging, including the all new UltraVIEW ERS, for high performance, rapid multidimensional imaging.

3. SPINELESS BIOLOGY! Carolina's Perfect Solution®
Invertebrate Anatomy Survey: Earthworm, Grasshopper, Crayfish, Mussel, Starfish, and Sponge

Sponsor: Carolina Biological Supply Company

Location: Tennessee Ballroom C

Time: 10:45AM

Carolina's Perfect Solution® specimens, the finest, safest available. Cooperative learning with dissection, the effective method to teach anatomy. Dissect, study, compare systems of invertebrate animals.

4. "Biology: An Interactive Exploration"

Sponsor: Brooks/Cole, Thomson Learning

Location: Tennessee Ballroom D

Time: 10:45AM

Can our teaching reflect the truth of the timeless pedagogical saying: Tell me and I will forget; Show me and I will understand; Have me do and I will know? Biology courses that emphasize concepts, interaction and iteration engage students in a way that they discover biological knowledge for themselves, and, in so doing, make it their own.

5. The Aurora Research Greenhouse by Conviron

Sponsor: Conviron

Location: Tennessee Ballroom D

Time: 12:15PM

Conviron, a company familiar to the research community as a provider of controlled environment chambers and rooms, has created a new product-the Aurora Research Greenhouse. The Aurora addresses the needs for uniform, precisely controlled, high performing and air-conditioned greenhouses. The workshop will discuss research applications for this new product.

6. Life in an Extreme Environment *Halobacterium* sp. NRC-1: A New Model Organism in the Classroom

Sponsor: Carolina Biological Supply Company

Location: Tennessee Ballroom C

Time: 1:45PM

This workshop introduces the new model microbe-*Halobacterium* sp. NRC-1! This safe, easy to handle, beautifully pigmented member of the Archaea is a great microbe for teaching microbiology, molecular biology, genetics, AP® Biology, bioinformatics and more. Great for teaching at all levels! Come find out more!

7. Nikon's Coolscope VS

Sponsor: Nikon Instruments, Inc

Location: Tennessee Ballroom D

Time: 1:45PM

A complete standalone digital microscope. Scan slides and capture high-resolution images with the click of a mouse. Learn how to create collections of virtual slides for teaching purposes, CD/DVD archivals and remote collaboration.

8. Wisconsin Fast Plants and C-Fern

Sponsor: Carolina Biological Supply Company

Location: Tennessee Ballroom C

Time: 3:15PM

Experience new, hands-on, minds-on activities with Wisconsin Fast Plants and C-Fern. These fascinating, diminutive, quick growing plants are ideal teaching tools for exploring life cycles, environmental effects, genetic variation, population biology and more while teaching students the process of doing science. Participants will do hands-on activities and receive free materials.

9. SQUID INK-UIRY: Inquiry-based Invertebrate Anatomy through Squid Dissection

Sponsor: Carolina Biological Supply Company

Location: Tennessee Ballroom C

Time: 4:45PM

Squid morphology and anatomy; basic cephalopod anatomy; hands-on, guided, basic dissection; detailed dissection of organ systems. Large specimens provide a clear view of invertebrate anatomy.

10. Engage and Amaze with Scope On A Rope

Sponsor: School Technology Resources

Location: Tennessee Ballroom D

Time: 3:15PM

The Scope On A Rope hand-held video camera microscope is a versatile and engaging classroom tool. This presentation will cover the benefits of such cameras to meet science standards and other presentation needs. Focus will be on benefits of imaging with the Scope On A Rope from the 1x lens up to the 400x lens for displaying documents, presentations, and other samples and objects. The Scope On A Rope can also connect to a computer for still image and movie capture so image manipulation and import into other programs will be discussed. Come see wonderful images from the everyday to the extraordinary.

ASB wishes to express many Thanks to the sponsoring participants in this year's Commercial Workshop program!!!!



2006 Association of Southeastern Biologists Exhibitors & Patron Members

(As of 13 Jan 06)

Associated Microscope (ASB Patron Member)

Quality Instruments for Business, Education or Home. Contact us toll free 800 476-3893 or visit us at www.associatedmicroscope.com.

Tim Atkinson (ASB Patron Member)

Brooks/Cole, Thomson Learning (ASB Patron Member)

The best teaching and learning solutions...for everything you need to know about life. Look here for texts and tools to meet all your teaching needs. Visit us online www.thomsonedu.com.

Carolina Biological Supply Company (ASB Patron Member)

Carolina Biological Supply Company serves the K-16 market with everything needed to equip a science laboratory or classroom. A complete catalog is free to educators. www.carolina.com.

Columbia Convention and Visitors Bureau

ASB 2007 Place of Meeting

Those who live here love it. Those who visit often find reasons to come back. There's a feeling here that's hard to describe, a vibrancy in the midst of comfortable calm. It's simple easy to here and convenient to get around. Columbia offers a sophisticated cultural scene; an active arts community; a wide range of recreation; exciting attractions and spectator sports; a creative, college town atmosphere; top-notch meeting and special event facilities and friendly locals who extend sincere and natural Southern hospitality welcomes. We invite you to explore Columbia, a true Southern city, proud of its heritage and excited about its future. Visit us online www.columbiacvb.org.

Conviron

Conviron will display information on their extensive line of plant growth chambers, incubators, and research greenhouses for the precise control of environmental conditions. Visit us online www.conviron.com.

Dennis, Breedlove & Associates (ASB Patron Member)

Breedlove, Dennis and Associates, Inc. (BDA) is a professional environmental and natural resources consulting firm incorporated in 1976. Since its inception, BDA has established a reputation for solving the most difficult environmental problems through the application of good science, knowledge of the regulations, and the ability to communicate with regulators and clients. BDA provides services to clients throughout the Southeastern United States. Call toll free 800/304-1882 or visit us online: www.bda-inc.com.

Electron Microscopy Sciences

Electron Microscopy Sciences offers a complete line of supplies and accessories for Microscopy and all related fields. Visit us online www.emsdiasum.com.

Great Smoky Mountains Association

Great Smoky Mountains Association is a non-profit group that supports the Great Smoky Mountains National Park through education, interpretation and research. Visit us online www.smokiesstore.org

Martin Microscope Company (ASB Patron Member)

Martin Microscope Company is based in the Southeastern United States, and is a retailer of new and used optical microscopes and accessories. A family business since 1946, Martin Microscope sells microscopes and accessories of many brands – providing the best combination of quality and affordability to our customers. Visit us online www.martinnmicroscope.com

McGraw-Hill Higher Education

McGraw-Hill provides leading texts, supplements and cutting-edge products for college-level science courses that help stimulate students' interest across the sciences. Visit us online www.mhhe.com

Mississippi State University

Graduate Programs, Department of Biological Sciences. Contact us 662/325-7579 or visit us online www.msstate.edu/dept/biosciences/bio.html

Marilyn Pendley (ASB Patron Member)**National Association of Biology Teachers**

The National Association of Biology Teachers (NABT) is "the leader in life science education." To date, more than 9,000 educators have joined NABT to share experiences and expertise with colleagues from around the globe; keep up with trends and developments in the field; and grow professionally. Visit us online www.nabt.org.

School Technology Resources

School Technology Resources provides hand-held video microscopes to be used with a TV and/or computer. Also known as the Scope On A Rope, they can be used as a digital camera, a document camera, a video camera, a presentation device and a microscope. These hand-held microscopes have a variety of detachable lenses that magnify from 1x to 750x. They are very easy to use, versatile, highly engaging and interactive. Visit us online www.Schooltr.com.

Southern Appalachian Botanical Society-SABS

The Southern Appalachians -the nonglaciated mountainous areas of Alabama, Georgia, South Carolina, North Carolina, Tennessee, Kentucky, Virginia, West Virginia, Maryland, Pennsylvania, and southwestern New York – form an evolutionary center for native plant diversity for the northern temperate regions of the world. In 1936 *The Southern Appalachian Botanical Club* was formed at West Virginia University for "all persons interested in the botany of the Southern Appalachian Mountains." Today, the name and purpose has changed slightly to the *Southern Appalachian Botanical Society* (SABS) with its focus on the botany of the eastern states. The membership includes professional and amateur botanists from across the country who are interested in eastern botany, in the journal, and in the activities of the society. Visit us online www.newberry.net/sabs/.

Southeastern Microscopy Society-SEMS

The Southeastern Microscopy Society is a scientific organization comprised of professional microscopists working in the life, medical, and physical sciences. The Society is dedicated to the advancement of scientific research and discovery through the use of microscopy and its associated methodologies. The Society also promotes microscopic imaging as an integral tool for life and physical sciences education at all levels. Visit us online www.semicroscopy.org

Nikon Instruments, Inc

Combining state-of-the-art capabilities with innovative designs to produce optically superior, ergonomically friendly products for cutting-edge scientific research. Visit us online www.nikonusa.com.

PerkinElmer Life and Analytical Sciences

Leading provider of drug discovery, genetic screening and chemical analysis tools and instrumentation. www.perkinelmer.com

Troy University Department of Biological and Environmental Sciences

Troy University offers an M.S. in Environmental and Biological Sciences. Visit our web site at: <http://troy.troy.edu/artsandsciences/biologicalsciences/index.html>.

US Dept of Energy Genomics: GTL Program

Learn about the Department of Energy's systems environmental microbiology research program for discovering new solutions to energy and environmental challenges. <http://doegenomestolife.org>

The University of Tennessee (2006 ASB Hosting University)

The University of Tennessee buzzes with energy, ideas, and optimism. Great professors and students from throughout the world live and work in a friendly, safe campus community located in scenic East Tennessee. The campus and its signature "Hill" lure students with green space, nearby lakes, and vistas of the Great Smoky Mountains National Park. Visit us online www.utk.edu.

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Join us in Gatlinburg!!!!



PROGRAM SUMMARY

ACTIVITY	TIME	LOCATION
TUESDAY, 28 MARCH		
Exhibitor Move In	12:00 pm-4:00 pm	CC-Tennessee Ballroom A & B
WEDNESDAY, 29 MARCH		
Registration	8:00 am-8:00 pm	Convention Center
Commercial workshop 1	9:15-10:00 am	CC-TN Ballroom C
Commercial workshop 2	9:15-10:00 am	CC-TN Ballroom D
Commercial workshop 3	10:45-11:30 am	CC-TN Ballroom C
Commercial workshop 4	10:45-11:30 am	CC-TN Ballroom D
Commercial workshop 5	12:15-1:00 pm	CC-TN Ballroom D
Commercial workshop 6	1:45-2:30 pm	CC-TN Ballroom C
Commercial workshop 7	1:45-2:30 pm	CC-TN Ballroom D
Commercial workshop 8	3:15-4:00 pm	CC-TN Ballroom C
Commercial workshop 9	4:45-5:30 pm	CC-TN Ballroom C
Exhibitor Move In	9:00 am-4:00 pm	CC-Tennessee Ballroom A & B
Exhibitor Pizza Party	12:00- 2:00 pm	CC-Tennessee Ballroom A & B
SEMS Executive Council meeting and Lunch	12:00-2:00 pm	GS-Magnolia Room
ASB Executive Council meeting	1:00-5:30 pm	GS-Azalea Room
SABS Executive Council meeting	2:00-5:30 pm	GS-Dogwood 1
SSP Executive Council meeting	2:00-5:00 pm	CC-Gatlinburg A
SSP Presidential Symposium	5:30-7:30 pm	CC-Gatlinburg A
ASB Plenary Session- Dr. Peter White	6:00-7:30 pm	CC-Mills Auditorium
ASB/University of Tennessee, Division of Biology— Welcome Reception, featuring the Woodpickers.	7:30-9:00 pm	CC-Tennessee Ballroom A & B
THURSDAY, 30 MARCH		
Past President Breakfast	7:00-8:30 am	GS-Azalea Room
SHC Executive Board Breakfast	7:00-8:30 am	GS-Dogwood Room
Registration	8:00 am-4:30 pm	Convention Center
Exhibit Area Opened	8:00 am-4:30 pm	CC-TN Ballroom A & B
Poster Set Up	8:00-9:00 am	CC-TN Ballroom A & B
Powerpoint Preview	8:00 am-4:30 pm	CC- Board Room

Morning Paper/Poster Sessions	8:30 am-12:00 pm	
Poster Viewing	8:30 am-12:00 pm	CC-TN Ballroom A & B
Symposium: ATBI: "A search for Species in our own Backyard" Part 1	8:45 am-12:00 pm	CC-TN Ballroom C
SSP Session I	8:30 am-12:00 pm	CC-Gatlinburg A
SEMS Session I *	8:30 am-12:00 pm	CC-Gatlinburg B
Aquatic Wetland and Marine Management	8:30 am-12:00 pm	CC-Room 1
Genetics, Cell & Molecular Biology	8:30 am-12:00 pm	CC-Room 2/3
Ichthyology	8:30 am-12:00 pm	CC-Room 4/5
Plant Ecology Session I	8:30 am-12:00 pm	CC-Room 6/7
Plant Ecology Session II	8:30 am-12:00 pm	CC-Room 8/9
Microbiology	8:30 am-12:00 pm	CC-Room 10/11
LUNCH	12:00-1:30 pm	
SWS Luncheon	12:00-1:30 pm	GS-Azalea Room
Women, Minorities, and People of disabilities Luncheon and Workshop	12:00-2:00 pm	CC-10/11
Tri-Beta Lunch and Field Trip	12:00-4:30 pm	Aquarium of the Smokies
Afternoon Paper/Poster Sessions	1:30-5:00 pm	
Authors with Even numbers with Posters	1:30-2:30 pm	CC-TN Ballroom A & B
Poster Viewing	2:30-5:00 pm	CC-TN Ballroom A & B
Symposium: ATBI: "A search for Species in our own Backyard" Part 2	1:30-5:00 pm	CC-TN Ballroom C
Plant Systematics Session I	1:30-5:00 pm	CC-TN Ballroom D
SSP Session II	1:30-5:00 pm	CC-Gatlinburg A
SEMS Session II*	1:30-5:00 pm	CC-Gatlinburg B
Teaching Biology	1:30-5:00 pm	CC-Room 2/3
Invertebrate Zoology	1:30-5:00 pm	CC-Room 4/5
Plant Ecology III	1:30-5:00 pm	CC-Room 6/7
Plant Ecology IV	1:30-5:00 pm	CC-Room 8/9
Beer and Bandana Bash (Thursday Night Social)	6:00-11:00 pm	CC-Mills Auditorium

FRIDAY, 31 MARCH

SABS/BSA Breakfast/ Business Meeting	7:00-8:30 am	GS-Azalea Room
SEMS Breakfast	7:00-8:30 am	GS-Dogwood Room
Registration	8:00 am- 1:30 pm	Convention Center
Exhibit Area Opened	8:00 am-1:30 pm	CC-TN Ballroom A & B

Powerpoint Preview	8:00 am-4:30 pm	CC- Board Room
TriBeta Business Meeting	8:30-11:00 am	CC-Room 10/11
ASB Business Meeting	11:15 am-12 pm	CC TN Ballroom D

Morning Paper/Poster Sessions

Authors with Odd numbers with Posters	8:30 am-9:30 am	CC-TN Ballroom A & B
Poster Viewing	9:30-12:00 pm	CC-TN Ballroom A & B
Plant Systematics Session II	8:30 am-11:15 pm	CC-TN Ballroom C
Animal Ecology	8:30 am-11:15 pm	CC-TN Ballroom D
SSP Session III	8:30 am-11:15 pm	CC-Gatlinburg A
SEMS Session III*	8:30 am-11:15 pm	CC-Gatlinburg B
Plant Biology	8:30 am-11:15 pm	CC-Room 2/3
Herpetology	8:30 am-11:15 pm	CC-Room 4/5
Animal Biology, Animal Physiology, Ornithology	8:30 am-11:15 pm	CC-Room 6/7
Plant Ecology Session V	8:30 am-11:15 pm	CC-Room 8/9

LUNCH

12:00-1:30 pm

Society of Herbarium Curators		
Business Meeting	1:00-2:00 pm	CC-TN Ballroom C
ESA/SE Luncheon	12:00-1:30 pm	GS-Azalea Room
SSP Luncheon	12:00-1:30 pm	GS-Dogwood Room 1
Take Posters Down	12:00-1:30 pm	CC-TN Ballroom A & B

Afternoon Paper Sessions

1:30 -5:00 pm

Symposium/Workshop: Bioinformatics: Community Standards and

Research Questions		
Animal Ecology	2:00-5:30 pm	CC-TN Ballroom C
SEMS Session IV*	1:30-5:00 pm	CC-TN Ballroom D
Tri Beta	1:30-5:00 pm	CC-Gatlinburg B
Tri Beta	1:30-5:00 pm	CC-Gatlinburg A
Tri Beta	1:30-5:00 pm	CC-Room 1
Herpetology	1:30-5:00 pm	CC-Room 2/3
Plant Ecology VI	1:30-5:00 pm	CC-Room 4/5
Social Hour-CASH BAR	6:00-7:00 pm	CC-TN Ballroom Pre-function Area
ASB Awards Banquet	7:00-10:00 pm	CC-TN Ballroom A & B

SATURDAY, 1 APRIL

ASB Ex Committee Breakfast	7:00-8:00 am	GS-Azalea Room
ASB Ex Committee Meeting	8:00-11:00 am	GS-Azalea Room

Field Trip 1: Birding in the Smokies

7:00 am-12:00 pm GSMNP: Sugarlands
Visitor Center

Field Trip 2: Aquatic Insects in the Smokies

8:00 am-12:00 pm GSMNP: Sugarlands
Visitor Center

Field Trip 3: Plant Communities of the Smokies

8:00 am-12:00 pm GSMNP: Sugarlands
Visitor Center

Field Trip 4: Salamanders of the Smokies

8:00 am-12:00 pm GSMNP: Sugarlands
Visitor Center

Field Trip 5: Bears and Boars of the Smokies

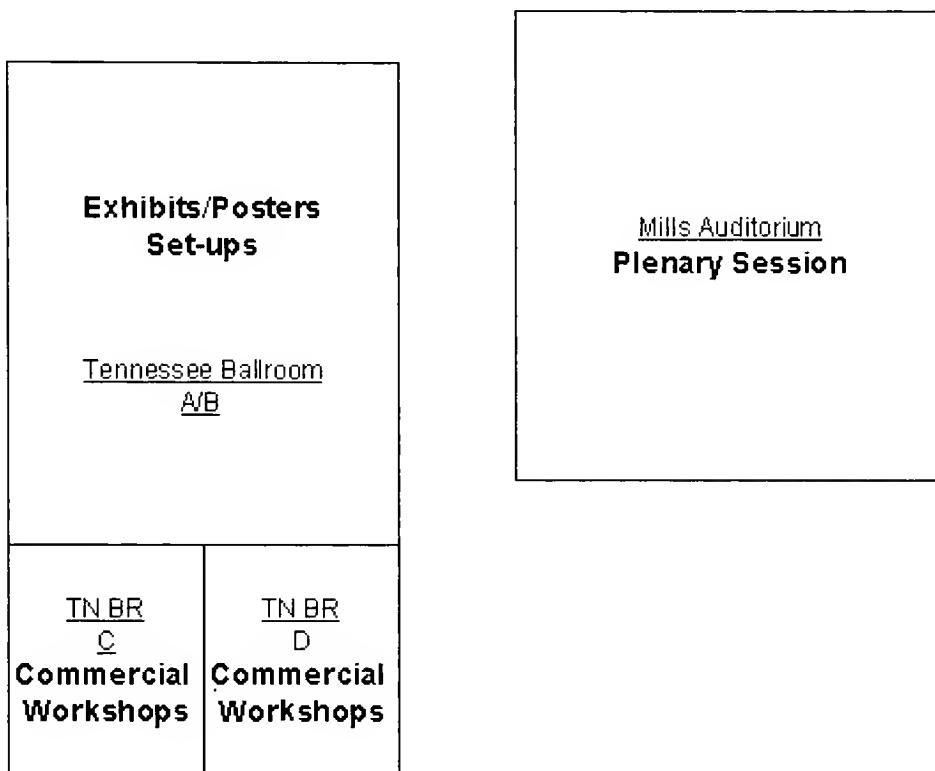
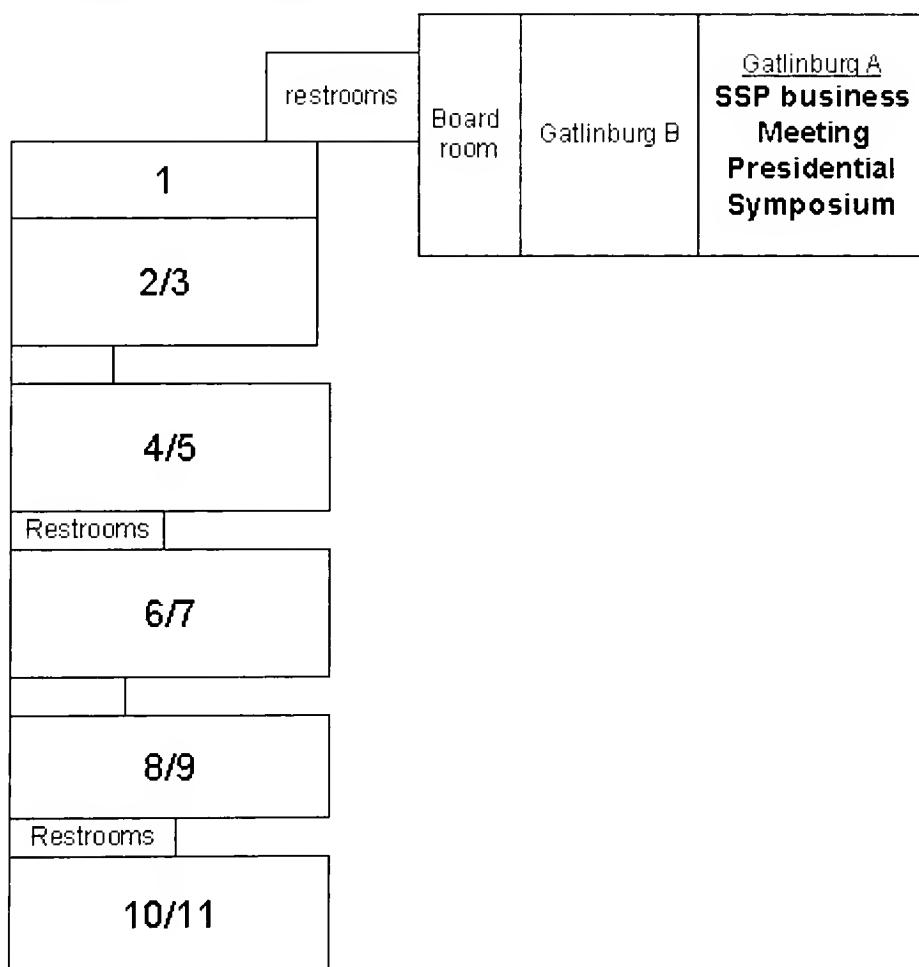
8:00 am-12:00 pm GSMNP: Sugarlands
Visitor Center

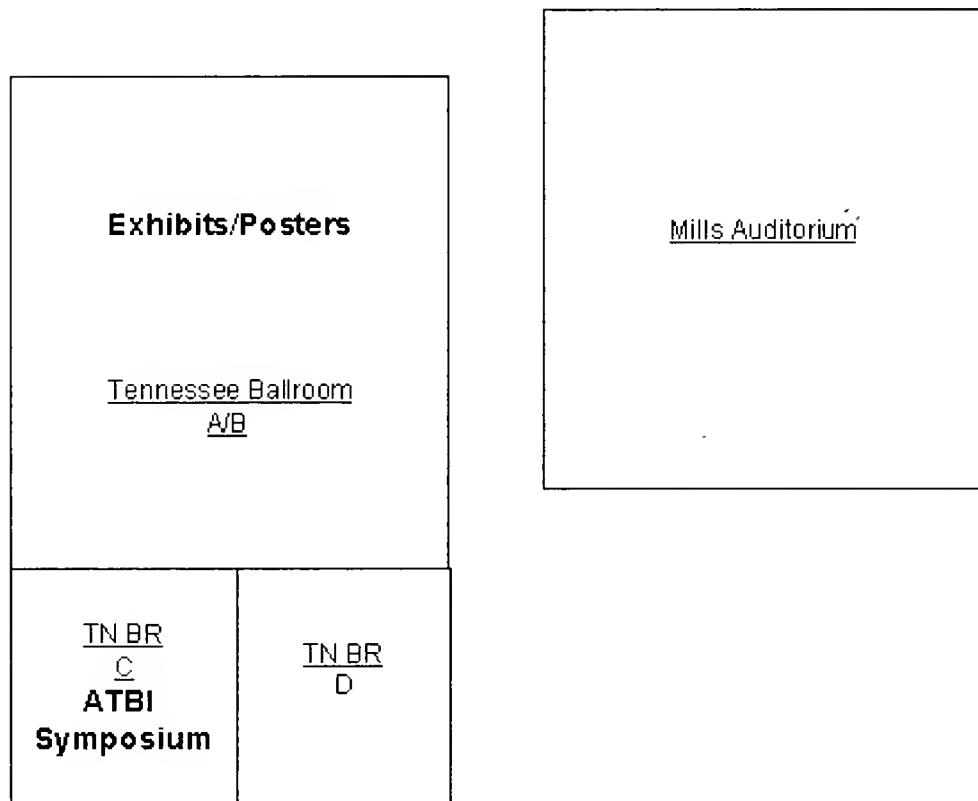
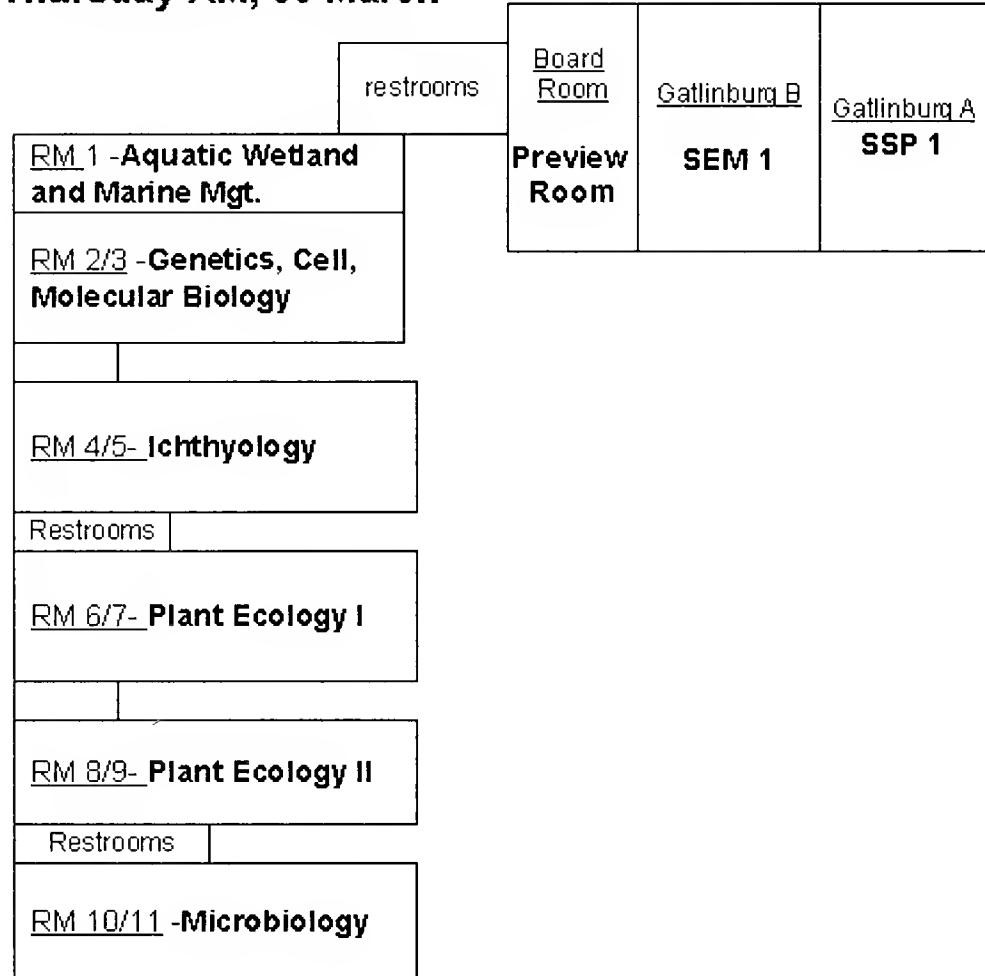
* SEMS is a new affiliate and their program will be made available at
Registration.

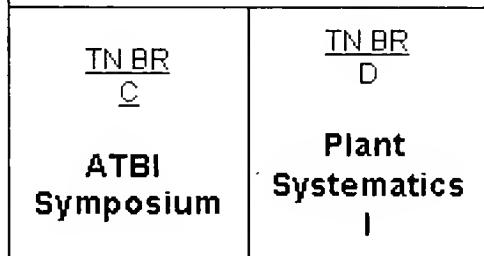
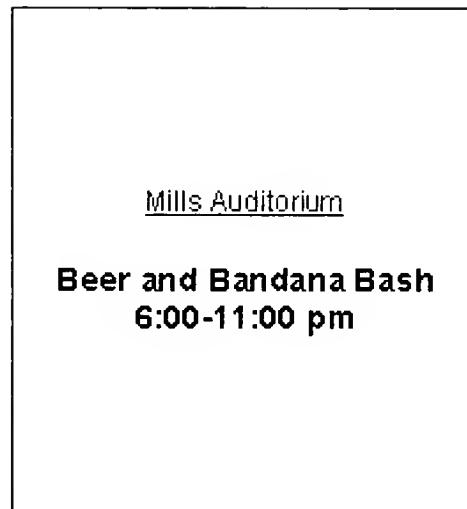
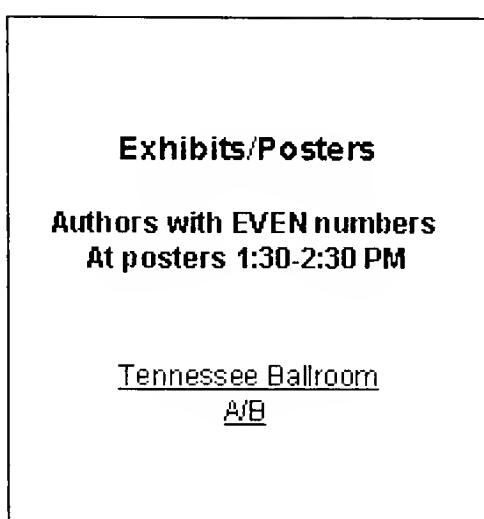
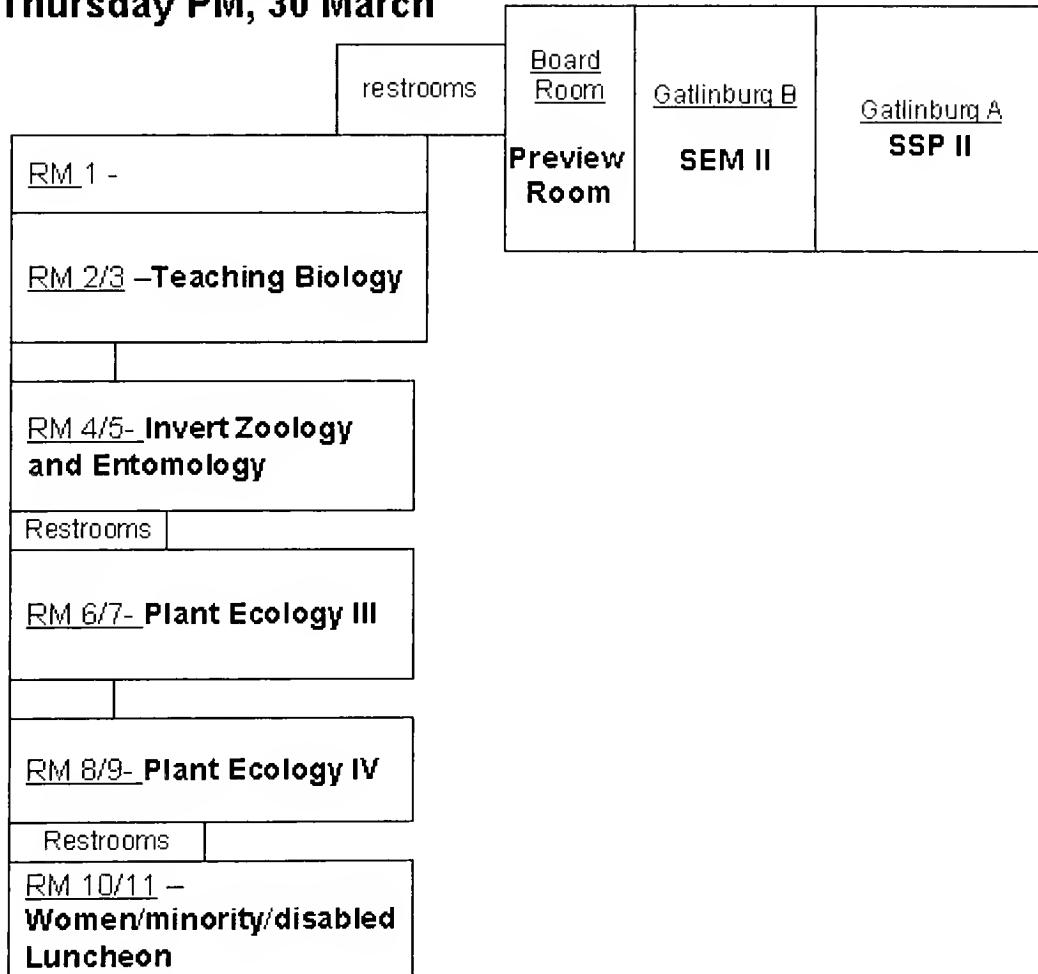
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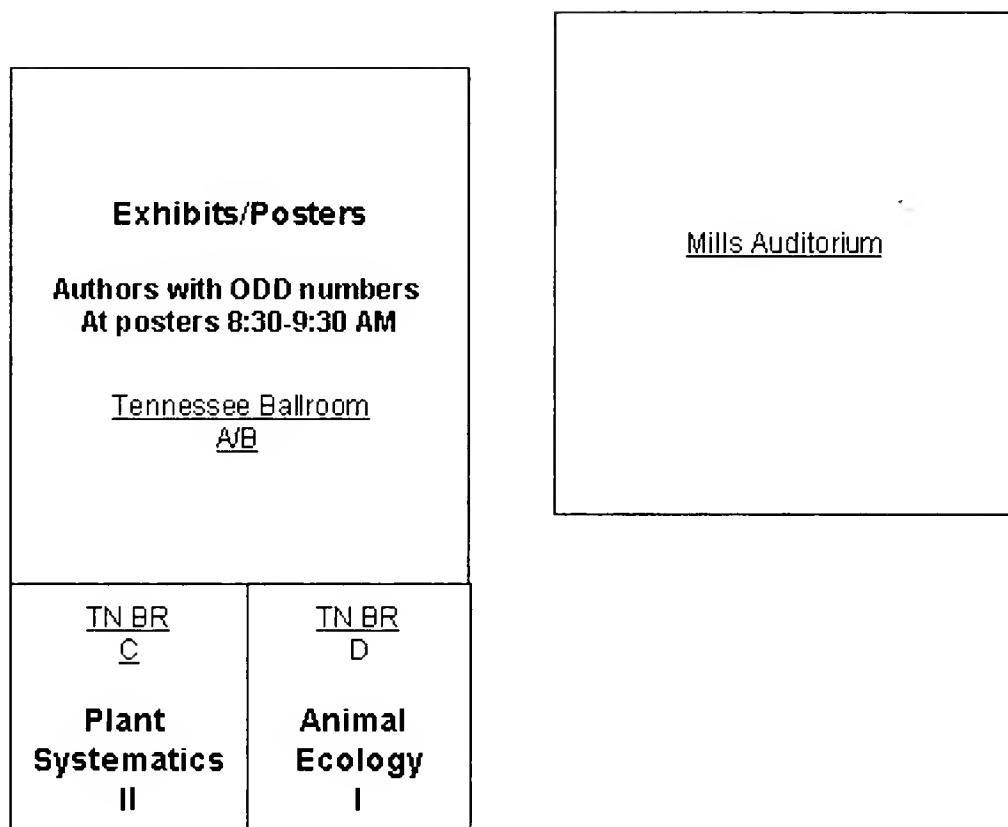
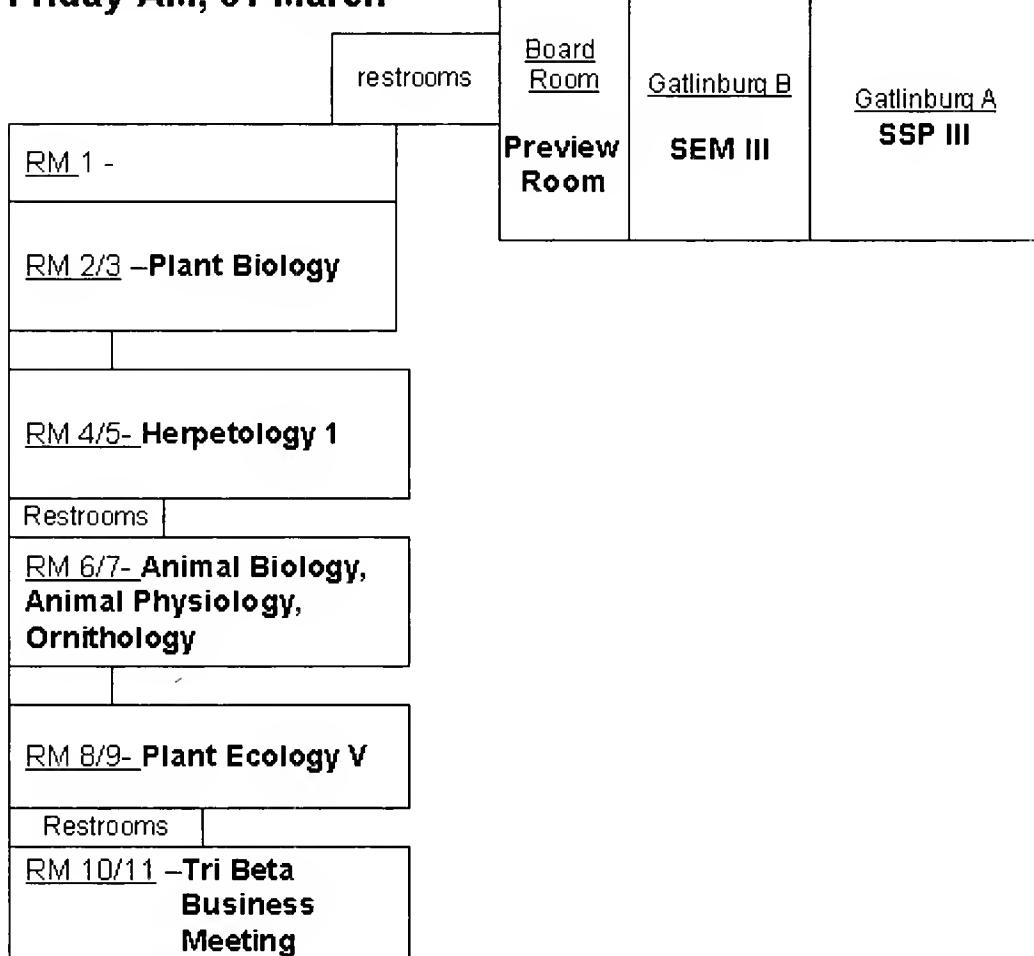


Cades Cove, Great Smoky Mountains National Park.
Photo by Marilyn Caponetti, Knoxville.

ASB 2006 MEETING – GATLINBURG CONVENTION CENTER**Wednesday, 29 March****Wednesday , 29 March**

Thursday AM, 30 March**Thursday AM, 30 March**

Thursday PM, 30 March**Thursday PM, 30 March**

Friday AM, 31 March**Friday AM, 31 March**

Friday PM, 31 March

<p>Exhibit hall closes at 1:30 pm</p> <p>Posters need to be taken down Between 12:00-1:30 pm</p> <p>Awards Banquet 7:00 pm</p> <p><u>Tennessee Ballroom</u> A/B</p>	
<p><u>TN BR</u> <u>C</u> SHC-Business meeting</p> <p><u>TN BR</u> <u>D</u></p> <p>Bioinformatics Symposium/ Workshop/</p> <p>Animal Ecology II</p>	

<u>Mills Auditorium</u>

Friday PM, 31 March

	<p>restrooms</p>	<p><u>Board</u> <u>Room</u></p>	<p><u>Gatlinburg B</u></p>	<p><u>Gatlinburg A</u></p>
<p><u>RM 1 -Tri-Beta</u></p>		<p><u>Preview</u> <u>Room</u></p>	<p><u>SEM IV</u></p>	<p><u>Tri-Beta</u></p>
<p><u>RM 2/3 -Tri-Beta</u></p>				
<p><u>RM 4/5- Herpetology II</u></p>				
<p>Restrooms</p>				
<p><u>RM 6/7-</u></p>				
<p><u>RM 8/9- Plant Ecology VI</u></p>				
<p>Restrooms</p>				
<p><u>RM 10/11 -</u></p>				

**LOCAL COMMITTEE ASSIGNMENTS
FOR THE 67th ANNUAL MEETING
UNIVERSITY OF TENNESSEE
KNOXVILLE, TENNESSEE**

MEETING SITE: GATLINBURG, TENNESSEE

<i>Local Arrangements Co-Chairs:</i>	Patricia B. Cox pbcox@tva.gov	865-632-3609
	Randall Small rsmall@utk.edu	865-974-3065
<i>Program Committee:</i>	Jake Weltzin jweltzin@utk.edu	865-974-3065
	Karen Hughes khughes@utk.edu	865-974-3065
	Joseph H. Williams joewill@utk.edu	865-974-3065
<i>Commercial Exhibits:</i>	Scott Jewell a2zconvention@yahoo.com	336-421-0034
<i>Field Trips:</i>	Ken McFarland kdmcfarl@utk.edu	865-974-6841
	Edward Clebsch eclebsch@utk.edu	865-974-6841
<i>Social Events:</i>	Scott Jewell Patricia B. Cox Randall Small	
<i>Transportation/Parking/ Tourism:</i>	Scott Jewell	336-421-0034
<i>Workshops:</i>	Scott Jewell	
<i>On-Site Registration:</i>	James Caponetti jcaponet@utk.edu	865-974-6841
<i>Tri-Beta:</i>	Edgar Lickey elickey@utk.edu	865-974-3065

AFFILIATE SOCIETIES MEETING WITH ASB IN MARCH-APRIL 2006

HOST: THE UNIVERSITY OF TENNESSEE, KNOXVILLE

The following affiliate societies, except the SE Division of ASIH and the **Southeastern Fishes Council**, will be in attendance at the 2006 Annual Meeting. We anticipate an excellent diversity of paper and poster presentations. The societies and their contacts are listed below.

American Society of Ichthyologists and Herpetologists

Southeastern Division

Dr. Gregory L. Fulling
Senior Fisheries Biologist/
Geo-Marine, Inc.
550 East 15th Street
Plano, TX 75074
(972) 423-5480; Fax: (972) 422-2736
e-mail: gfulling@geo-marine.com

e-mail: lmusselm@odu.edu
<http://web.odu.edu/lmusselman>

Ecological Society of America Southeastern Chapter

Dr. James O. Luken
Dept. of Biology, P.O. Box 261954
Coastal Carolina University
Conway, SC 29528-6054
(843) 349-2235; Fax: (843) 349-2201
e-mail: JoLuken@coastal.edu

Beta Beta Beta

Southeastern District I

Dr. Virginia Martin
Queens College of Charlotte
1900 Selwyn Avenue
Charlotte, NC 28274
(704) 337-2261
e-mail: martinv@rex.queens.edu

Society of Herbarium Curators

Dr. Michael Woods
Dept. of Biol. & Environ. Sciences
Troy University, Troy, AL 36082
(334) 670-3403; Fax: (334) 670-3662
e-mail: mwoods@troy.edu
<http://www.newberry.net/com/sabs/shc/index.htm>

Beta Beta Beta

Southeastern District II

Dr. Donald H. Roush
Dept. of Biology, Box 5181
University of North Alabama
Florence, AL 35632-0001
(256) 765-4435
e-mail: droush@unanova.una.edu

Society of Wetland Scientists South Atlantic Chapter

Dr. Steven J. Miller
St Johns River Water Management
District, P.O. Box 1429
Palatka, FL 32178
(386) 329-4387; Fax: (386) 329-4329
e-mail: sjmiller@sjrwmd.com

Botanical Society of America

Southeastern Division

Dr. Lytton John Musselman
Mary Payne Hogan Professor of
Botany and Chair
Department of Biological Sciences
110 Mills Godwin Building/45th St
Old Dominion University
Norfolk, VA 23529-0266
(757) 683-3595; Fax: (757) 683-5283

Southeastern Fishes Council

Dr. Noel M. Burkhead
USGS/FISC Geological Survey
Center for Aquatic Resource Studies
7920 NW 71st Street
Gainesville, FL 32653
(352) 378-8181; Fax: (352) 378-4956
e-mail: noel_burkhead@usgs.gov

Southeastern Microscopy Society

Dr. Judy King, President, SEMS
Department of Pathology
University of South Alabama
2451 Fillingim Street
Mobile, AL 36617-2293
(251) 471-7779; Fax: (251) 470-5817
e-mail: jking@usouthal.edu

University of Tennessee

2407 River Drive
Knoxville, TN 37996-4543
(865) 974-5718; Fax: (865) 974-6232
e-mail: ctfaulkner@utk.edu

Southeastern Society of Parasitologists

Dr. Charles Faulkner
Dept. of Comparative Medicine
College of Veterinary Medicine

Southern Appalachian Botanical Society

Dr. Michael E. Held
Dept. of Biology, Saint Peter's College
Jersey City, NJ 07306
(201) 915-9189; Fax: (201) 915-9191
e-mail: MHSavanna@aol.com

**NEW ASB AFFILIATE****SOUTHEASTERN MICROSCOPY SOCIETY**

<http://www.semicroscopy.org>

Organized in 1964, the Southeastern Microscopy Society (SEMS) is a scientific organization comprised of professional microscopists working in the life, medical, and physical sciences. SEMS is dedicated to the advancement of scientific research and discovery through the use of microscopy and its associated methodologies. SEMS also promotes microscopic imaging as an integral tool for life and physical sciences education at all levels.

The Ruska Award is SEMS' annual student research award. It is named after Ernst and Helmut Ruska, the former an inventor of the electron microscope, and the latter an eminent biologist. Ernst Ruska was awarded the Nobel Prize in 1986 for his work. We encourage students to present and compete for the award. Students must have a sponsor who is a member of SEMS.

SEMS holds an annual scientific meeting in the southeastern region of the United States each spring. Scientific presentations and the business of the organization are conducted at this meeting. We plan on having our annual meeting with ASB in Gatlinburg, Tennessee, March 29-April 1, 2006.

Judy King, M.D., Ph.D.
President, SEMS
Department of Pathology
University of South Alabama
2451 Fillingim Street
Mobile, Alabama 36617-2293
Phone (251) 471-7779; Fax (251) 470-5817
Email jking@usouthal.edu

SOUTHEASTERN MICROSCOPY SOCIETY AWARDS

Ruska Award – The purpose of the Ruska Award is to recognize and reward student excellence in research in which microscopy is used as a research tool in biological and/or physical sciences. The Ruska Award is given to the best student presentation at the annual meeting. Ruska participants are required to send a written abstract with illustrations prior to the annual meeting and give an oral presentation at the meeting.

Distinguished Scientist Award – The Distinguished Scientist Award is given to members of long standing who exemplify personal and intellectual integrity, perennial scholarship, contributions to the field of microscopy, excellence in teaching and service to the society above and beyond the call of duty. The award is not given on a regular basis, but only at such times as individuals are identified by nomination.

Distinguished Corporate Member Award – The purpose of the Distinguished Corporate Member Award is to recognize and show appreciation to corporate members of long standing. The award is not given on a regular basis, but only at such times that corporate members are nominated.

Roth-Michaels Teaching Award – The purpose of the Roth-Michaels Teaching Award is to honor the contributions and commitment of two of our members, Dr. Ivan Roth and Dr. Gene Michaels, to microscopy education. Candidates for the Roth-Michaels award should have exemplified excellence in the teaching of microscopy at the primary and/or secondary levels of educations. The award will be given only at such times as individuals are identified by nomination.

Jerry Paulin Lectureship Award – The purpose of the Jerry Paulin Lectureship Award is to provide funding for an outstanding lecturer in any area of microscopy to attend and present a one-hour presentation at the annual meeting. These presentations should be held only when a candidate has been identified and funding is available to support a candidate.

For more information about SEMS awards please check the website at <http://www.semicroscopy.org>.



SPECIAL REMINDERS FROM THE PRINT EDITOR

ASB BANQUET ATTENDANCE

Please keep in mind that recipients of ASB awards must be present at the annual ASB banquet to receive the award. Therefore, all applicants for ASB awards must attend the banquet to insure the presence of the winners.

EXTRA ABSTRACT SUBMISSION

Besides sending abstracts of papers and posters to the Program Committee by November 18, 2005, anyone wishing to be considered for an award must send an abstract to the respective award committee chairperson in order to be considered. Checking the box on the registration form for the award is not enough. An abstract must be sent to the chairperson by January 7, 2006.

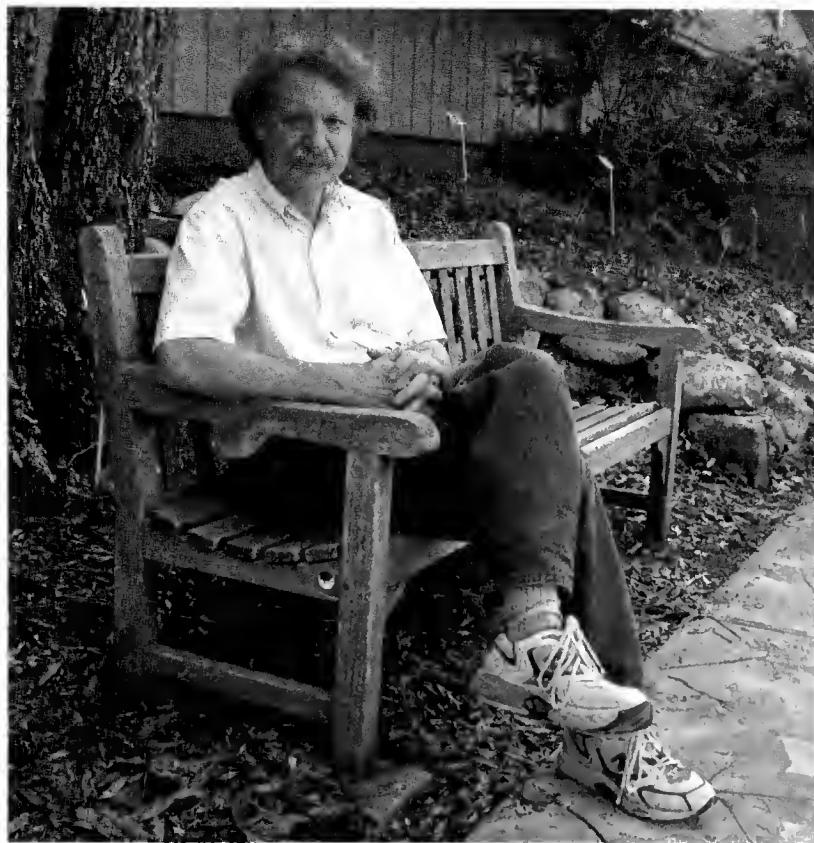
INSTRUCTIONS FOR SUBMITTING ORAL PRESENTATIONS

All oral presentations will be done using Microsoft PowerPoint only. Presenters should bring a backup copy as well as a backup consisting of overheads.

FINAL SUBMISSION OF CD

We are requesting that final presentations be submitted on CD to the program committee by March 24, 2006. The first author's name and truncated title should be written on the upper surface of the CD using an indelible marker.

Submit the CD by the March 24th deadline to: ATTN: ASB 2006 Annual Meeting, c/o Dr. Joseph H. Williams, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996-1610.

Plenary Speaker—Dr. Peter White

Dr. Peter White is the director of the North Carolina Botanical Garden, a garden which is helping to define the *Conservation Garden*. The Garden became one of the first gardens to enact policies aimed at diminishing the risk of release of exotic pest organisms in 1998 and was presented with a Program Excellence Award in 2004 by the American Association of Botanical Gardens and Arboreta. Dr. White is a plant ecologist with interests in communities, floristics, biogeography, species richness, conservation biology and disturbance and patch dynamics, received his B.A from Bennington College (1971) and Ph.D. from Dartmouth College (1976). In vegetation science he is interested in the composition and dynamics of plant communities, the relationship between vegetation and landscape, and role of disturbance, and the ecology of individual species in a dynamic setting. In conservation biology he is interested in the distribution and biology of rare species, the design and management of nature reserves and alien species invasions. Peter is an active member of many professional societies and his many duties include: an Editor of the Journal of Vegetation Science and Applied Vegetation Science, a board member for the North Carolina Plant Conservation Board, the Center for Plant Conservation, The North Carolina Nature Conservancy, and the Highlands Biological Station. He is Chair of Discover Life in America Board of Directors and co-chair of the Science Committee for the All Taxa Biodiversity Inventory in Great Smoky Mountains National Park.

Selected Recent Publications by subject (for a complete listing see <http://www.bio.unc.edu/faculty/white/references.htm>).



A DUES INCREASE REQUEST FROM THE ASB EXECUTIVE COMMITTEE

As all of us know, costs tend to increase over time. Our operating costs follow this trend and have increased significantly each year. Please review the following facts and give careful consideration to a request for an increase in membership dues. This will be put to a vote of the members at our 2006 business meeting in Gatlinburg.

Our last dues increase was at our 2002 meeting (Boone), effective 2003. This was a modest increase of only \$5 for Regular membership and no increase for student membership. Since then, publication expense for Southeastern Biology increased 13%. Our publication expense in 2004 was \$15,599. Our revenue from dues in 2004 was only \$12,180. Obviously, our revenue for membership dues is not even sufficient to pay for printing and mailing Southeastern Biology. Indeed, we go in the hole on each volume. Total expenses in 2002 were \$30,987, increasing by 2004 to \$52,166, a 41% increase. (Please remember, dues revenue for 2004 was only \$12,180!)

Of course, other costs have increased, too. For example, the amount of money advanced for an entire annual meeting in 1999 is today not enough even to pay for a *deposit* on a Thursday night event. This is not due to any ostentatious excess on our part, but simply to increases in the cost of almost everything we do.

Our checking account is showing steady erosion, a process that has inevitable limits and a certain and unpleasant outcome if we do not make some adjustment to the process.

The ASB Executive Committee recommends the following increase in our membership dues structure, effective 2007:

	Current	Increase to
Regular	\$25	\$35
Regular, 3 years	\$65	\$95
Student	\$10	\$15
Family	\$30	\$40
Emeritus	\$10	\$15
Contributing	\$50	\$70
Sustaining	\$100	\$140
Life	\$250	\$350
Library	\$30	\$40
Library, 3 years	\$85	\$100
Patron	\$750	\$750 (no increase)

ASB PAPER AND POSTER SESSIONS**ASB PAPER SESSIONS****WEDNESDAY, MARCH 29, 2006****Presidential Symposium
Southeastern Society of Parasitologists
Gatlinburg A****Presiding: Jennifer Spencer, Auburn University**

- 5:30 1 **SPENCER, JENNIFER A.** College of Veterinary Medicine, Auburn University, AL–Vector-borne diseases: Ticks, bugs, and pathogens of importance to human and animal health.
- 5:45 2 **GRIJALVA, MARIO J.** Tropical Disease Institute, Biomedical Sciences Department, College of Osteopathic, Ohio University and Infectious Disease Research Laboratory, School of Biological Sciences, Catholic University of Ecuador–Chagas disease in Ecuador: Moving from research to control program implementation.
- 6:15 3 **BREITSCHWERDT, EDWARD B.** College of Veterinary Medicine, North Carolina State University, Raleigh, NC–Concurrent infection with *Anaplasma*, *Bartonella* and *Ehrlichia* species.
- 6:45 4 **BLAGBURN, BYRON L.** College of Veterinary Medicine, Auburn University, AL–Lean, Mean, Transmission Machines: The Biology of Ixodid Ticks.

THURSDAY, MARCH 30, 2006**MORNING SESSION****All Taxa Biodiversity Inventory Symposium I:
A Search for Species in our own “Backyard”
Tennessee Ballroom C****Presiding: Patricia Cox, Tennessee Valley Authority and Ed Lickey, University of Tennessee**

- 9:00 5 **LANGDON, KEITH AND BECKY NICHOLS.** Great Smoky Mt. National Park– History and Introduction of ATBI
- 9:15 6 **O'CONNELL, SEAN.** Western Carolina University—Extensive bacterial diversity in soils and waters of Great Smoky Mountains National Park: How many species are out there?
- 9:30 7 **LICKEY, ED, KAREN HUGHES, AND RON PETERSEN.** University of Tennessee, Knoxville—Heterozygosity in *Artomyces pyxidatus* from the Great Smoky Mountains National Park.
- 9:45 8 **KELLER, HAROLD.** Southwest Missouri University—Tree Canopy biota in the Great Smoky Mountains National Park.

- 10:00 9 **LOWE, REX, AND JEFF JOHANSEN.** Bowling Green University and John Carroll University—Diatom species (Bacillariophyceae) from sub aerial habitats in the Great Smoky Mountains National Park.
- 10:15 10 **JOHANSEN, JEFFREY AND REX LOWE.** John Carroll University and Bowling Green University—New algal records from Great Smoky Mountains National Park.
- 10:30 11 **COX, PATRICIA AND RICHARD SCHULZ.** Tennessee Valley Authority and GSMNP—Pteridophyte distribution in the GSMNP.
- 10:45 **COFFEE BREAK**
- 11:00 12 **WETZEL, MARK AND PEGGY MORGAN.** Illinois Natural History Museum—The Aquatic Oligochaeta and other annelids in the Great Smoky Mountains National Park.
- 11:15 13 **BERNARD, ERNEST.** University of Tennessee, Knoxville—Biodiversity explosion: Collembola of Great Smoky Mountains National Park (GRSM).
- 11:30 14 **OLIVER S. FLINT, JR.¹, LUKE M. JACOBUS², W. PATRICK McCAFFERTY², BORIS C. KONDRATIEFF³, JOHN C. MORSE⁴ AND CHARLES R. PARKER⁵.** National Museum of Natural History, Smithsonian Institution¹, Purdue University², Colorado State University³, Clemson University⁴, U. S. Geological Survey⁵—The aquatic insect fauna of Great Smoky Mountains National Park
- 11:45 15 **CARLTON, CHRIS AND VICTORIA BAYLESS.** Louisiana State University Arthropod Museum—Documenting beetle diversity in the Smokies; past the half-way point!

Southeastern Society of Parasitologists I Gatlinburg A

Presiding: Charles Faulkner, University of Tennessee

- 8:30 16 **YOUNG, JOY AND GEORGE W. BENZ.** Middle Tennessee State University—Rapid colonization of neonate lemon sharks by monogeneans.
- 8:45 17 **MCELWAIN, ANDREW AND GEORGE W. BENZ.** Middle Tennessee State University—Reconsidering phylogeny within Sphyriidae (Siphonostomatoida, Copepoda).
- 9:00 18 **COOK, JOSHUA O¹., ROBIN M. OVERSTREET¹ AND R. RAMA KRISHNA².** The University of Southern Mississippi, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS¹ and ANGR Agricultural University, Andhra Pradesh, India²—Pathology associated with fatal myxozoan infections in farmed carp, *Catla catla*, from India.

- 9:15 19 **BAKER, TIFFANY G.¹ AND ISAURE DE BURON².** Grice Marine Laboratory¹ and Biology Department², College of Charleston, SC–Stock identification of the Atlantic croaker, *Micropogonias undulatus* Linnaeus, using macroparasites as biological tags.
- 9:30 20 **LUCAS, A¹, W. S. SWECKER¹, G. SCAGLIA², D. S. LINDSAY¹, F. C. ELVINGER¹, J. P. FONTENOT², AND A. M. ZAJAC¹.** VA/MD Regional College Of Veterinary Medicine¹ and Dept. Of Animal And Poultry Sciences², Virginia Tech–Population dynamics of *Eimeria* spp in grazing beef calves in Virginia.
- 9:45 21 **GOODWIN, DAVID G., SOLANGE M. GENNARI², DANIEL K. HOWE³, J.P. DUBEY⁴, ANNE M. ZAJAC¹, AND DAVID S. LINDSAY¹.** Virginia Tech¹, Universidade de São Paulo², University of Kentucky³, USDA Animal Parasitic Diseases Laboratory⁴–Prevalence of antibodies to *Encephalitozoon cuniculi* in Brazilian horses.
- 10:00 **COFFEE BREAK**
- 10:15 22 **LASCANO, MAURICIO S.^{1,3}, ANITA VILLACIS², AND MARIO J. GRIJALVA³.** Department of Biological Sciences, Ohio University, Athens, OH¹. School of Biological Sciences, Catholic University, Quito, Ecuador². Tropical Disease Institute, Biomedical Sciences Department, College of Osteopathic Medicine, Ohio University, Athens, OH³–Molecular characterization of *Trypanosoma rangeli* isolates from Ecuador.
- 10:30 23 **PINTO, C. MIGUEL^{1,2}, SOFÍA OCAÑA¹, MAURICIO LASCANO³, AND MARIO J. GRIJALVA³.** Laboratorio de Investigación en Enfermedades infecciosas, Escuela de Ciencias Biológicas, Pontificia Universidad Católica del Ecuador, Quito, Ecuador¹; Present address: Department of Biological Sciences, Texas Tech University, Lubbock, TX, USA²; Tropical Disease Institute, College of Osteopathic Medicine, Department of Biomedical Sciences, Ohio University, Athens OH, USA³–Infection by trypanosomes in marsupials and rodents associated to human dwellings in Ecuador.
- 10:45 24 **WIMSETT, ASHLEY, AMY ANDERSON, AND CHRIS HALL.** Department of Biology, Berry College, Mount Berry Ga.–Humoral recognition of *Trypanosoma cruzi* antigens in raccoons from the Berry College campus.
- 11:00 25 **PIERCE, EMILY, BRAD MEERS, AND CHRIS HALL.** Department of Biology, Berry College, Mount Berry Ga.–Vertical Transmission of North American Type II and a South American Type I isolates of *Trypanosoma cruzi* in BALB/c mice.
- 11:15 26 **VINCENT, AMANDA G. AND JEFFREY M. LOTZ.** Gulf Coast Research Laboratory, The University of Southern Mississippi–Evolution of virulence: transmission from dead hosts.
- 11:30 27 **HARRIS, SHAWNA AND CLAIRE A. FULLER.** Murray State University–Immunity in dragonfly naiads (Odonata: Anisoptera): indicators of water quality.

- 11:45 28 **SAVAGE, MASON Y. AND MICHAEL J. YABSLEY.** Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia—Sequence polymorphisms in the mismatch-repair (*TcMSH2*) and glutathione-S-transferase (*Tc52*) genes of *Trypanosoma cruzi* isolates from United States wildlife.

Aquatic Wetland and Marine Management
Room 1

Presiding: Gregory Noe, U. S. Geological Survey

- 9:00 29 **SELLERS, P¹, L. LOCKHART², AND L. SIMPSON³, AND ANDREW KEEWATIN⁴.** University of North Carolina at Pembroke¹, Winnipeg, Canada², Peterborough, Canada³ and Grassy Narrows, Canada⁴—Mercury in the sediment and crayfish of lakes in the territories of Anishinabek people: 25 years after the big mercury spill.
- 9:15 30 **PITCHFORD, JONATHAN, TONY GRECO, AND MICHAEL WINDLESPECT.** Appalachian State University—Influence of metal pollution and concurrent biofilm production on benthic macroinvertebrates in a disturbed high elevation wetland.
- 9:30 31 **FINCEL, MARK J., CHARLES L. PEDERSON AND ROBERT U. FISHER.** Eastern Illinois University—Flow variability and the effects of municipal sanitary discharge on downstream fish and invertebrate communities.
- 9:45 32 **NOE, GREGORY¹, JUDSON HARVEY¹, AND JAMES SAIERS².** U.S. Geological Survey¹ and Yale University²—Suspended particles in Everglades wetlands: characterization and importance to phosphorus transport.
- 10:00 33 **ZOELLNER, DANIELLE C., JAMES LUKEN AND KEITH WALTERS.** Coastal Carolina University—Response of *Juncus roemerianus* to Restoration of Saltwater Influence in Sandpiper Pond, Huntington Beach State Park, South Carolina.
- 10:15 **COFFEE BREAK**
- 10:30 34 **EZELL, P. TAYLOR, BENJAMIN M. COALE, JONATHAN M. MILLER, AND NEIL BILLINGTON.** Troy University—Comparison of Trophic State Index (TSI) for Southeast Alabama ponds.
- 10:45 35 **PILARCZYK, MEGAN M.¹ AND PAUL M. STEWART².** Wake Forest University¹ and Troy University²—Contemporary and recent historical freshwater mussel assemblages in the Gulf Coastal Plains of Alabama and Florida.
- 11:00 36 **GEORGE, ROBERT Y. AND JULIA KIRKLAND BERGER.** George Institute for Biodiversity and Sustainability—Concept of “Biobank” and Species Inventory: Priorities in the Southeastern United States.

- 11:15 37 **OGASAWARA, MASAMICHI.** Clemson University—A comparison of spatial variability associated with ephemeral wetland ponds in the Duke Forest, North Carolina.
- 11:30 38 **DIRNBERGER, JOSEPH, WILLIAM ENSIGN, STEVEN RANNEY, JOSH SMITH, ERIN SQUIRES AND RYAN STONER.** Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Physical and biological signals in streams along an ecoregion boundary.

Genetics, Cellular and Molecular Biology
Room 2/3

Presiding: John Stiller, East Carolina University

- 8:30 39 **VANDANA, CHATURVEDI, RAJA KUMARAGURU, LAKSHMI PULAKAT, NARA GAVINI.** Mississippi State University—Amino Terminus of NifM acts as a regulatory region for the Peptidyl prolyl cis/trans isomerasases activity of NifM.
- 8:45 40 **JOHNSON, MARY AND DWAYNE WISE.** Mississippi State University—Characteristics of Kinetochore movement in cells undergoing mitosis without replication.
- 9:00 41 **CHAMBERS, MELISSA G. AND DWAYNE WISE.** Mississippi State University—Is a spindle matrix a common feature of mitosis?
- 9:15 42 **RAVINDRA, KOLHE, NARA GAVINI AND LAKSHMI PULAKAT.** Mississippi State University, Mississippi State—Insulin receptor-angiotensin II receptor AT1 association results in development of insulin resistance.
- 9:30 43 **LIU, PENGDA AND JOHN W. STILLER.** East Carolina University—Mutational analysis of the essential functional sequence in the yeast RNA polymerase II C-terminal domain.
- 9:45 44 **AGHORAM, KARTHIK¹, MATTHEW R. KEOGH², JEFFREY W. GILLIKIN, MICHAEL GOSHE², ERIK J. SODERBLOM² AND RALPH E. DEWEY².** Meredith College and North Carolina State University—Phospholipid signaling pathway in plants—the role of a hyperosmosis-activated protein kinase.
- 10:00 45 **DIEHL, WALTER J.** Mississippi State University—Gene function and phylogeny affect patterns of natural selection in the Mycoplasmatales.
- 10:15 **COFFEE BREAK**
- 10:30 46 **BHATTARAI, SMRITI AND ALICIA WHATLEY.** Troy University—Induction of cytochrome P450 in channel catfish (*Ictalurus punctatus*) following exposure to Troy (Alabama) waste water treatment plant effluent.
- 10:45 47 **STILLER, JOHN W. AND LESLIE HARRELL.** East Carolina University—The kingdom Plantae hypothesis: functional constraint and short-branch exclusion in deep molecular phylogeny.

- 11:00 48 **RITTER, STEFANIE AND VICTORIA TURGEON.** Furman University—The Effects of Trypsin Inhibitor on Axon Direction, Elongation, and Motoneuron Survival.
- 11:15 49 **BOBOWSKI, CHRISTIE AND ELI V. HESTERMANN.** Furman University—Combinatorial gene regulation by the estrogen and aryl hydrocarbon receptors.
- 11:30 50 **TALLEY, JENNELL M., JENNIFER L. OSTERHAGE AND KATHERINE L. FRIEDMAN.** Vanderbilt University—Regulation of Est1p by degradation in G1 phase of the cell cycle.
- 11:45 51 **MCHUGH, ROBERT, SMRITI BHATTARAI, CHRISTI MAGRATH, PHILLIP REYNOLDS, AND ALICIA WHATLEY.** Troy University—A putative cytochrome p450 mRNA induced by exposure to waste water treatment effluent in channel catfish

Ichthyology Room 4/5

Presiding: Benjamin Keck, University of Tennessee

- 9:00 52 **KECK, BENJAMIN P. AND THOMAS J. NEAR.** University of Tennessee—Hybridization in *Nothonotus* darters (Percidae).
- 9:15 53 **BOSTROM, BETHANY S.¹, ROBERT U. FISCHER¹, CHARLES L. PEDERSON¹, SCOTT J. MEINERS¹ AND DAN E. SHOUP².** Eastern Illinois University¹ and Oklahoma State University²—Artificial Riffles as a Remediation Technique in Three Illinois Streams.
- 9:30 54 **KRAL, LEOS.** University of West Georgia—Multigenic analysis of the Tallapoosa darter population structure.
- 9:45 55 **RAKES, PATRICK L. AND J. R. SHUTE.** Conservation Fisheries, Inc.—Propagation of the warrior darter, *Etheostoma bellator*, as a surrogate for the endangered vermillion darter, *E. chermocki*.
- 10:00 56 **RAKES, PATRICK L.¹, SHUTE, J. R.¹ AND PEGGY W. SHUTE².** Conservation Fisheries, Inc.¹ and Tennessee Valley Authority²—Successful reintroduction of endangered fishes to Abrams Creek, Great Smoky Mountains National Park.
- 10:15 **COFFEE BREAK**
- 10:30 57 **HOWELL, J. HEATH AND BERNARD R. KUHAJDA.** University of Alabama, Tuscaloosa, Alabama—Life history characteristics of the Alabama darter (*Etheostoma ramseyi*) in Blue Girth Creek, Alabama.
- 10:45 58 **BENNETT, MICAH G. AND BERNARD R. KUHAJDA.** University of Alabama, Tuscaloosa, Alabama—Life history of the black madtom, *Noturus funebris*, in Blue Girth Creek, Cahaba River, Alabama.
- 11:00 59 **BILLINGTON, NEIL.** Troy University—Whole-molecule mitochondrial DNA RFLP variation in walleye and sauger.

- 11:15 60 **BARR, AMY, RACHAEL N. KOIGI, RONALD E CREECH, JANET GASTON, AND NEIL BILLINGTON.** Troy University—Genetic variation in sauger populations determined by protein electrophoresis.

Plant Ecology I
Room 6/7

Presiding: Gary Ervin, Mississippi State University

- 9:00 61 **CIRTAINT, MARGARET C. AND SCOTT B. FRANKLIN.** University of Memphis—Impact of selected environmental parameters on *Arundinaria gigantea* canebrake establishment and reintroduction.
- 9:15 62 **MILLER, BRADLEY W. AND TOM FOX.** Virginia Polytechnic Institute and State University—The long term effects of phosphorus fertilization on soil phosphorus availability.
- 9:30 63 **STEVENS, M. AND H. HENRY.** Miami University—Placing local plant species richness in the context of environmental drivers of metacommunity richness.
- 9:45 64 **ERVIN, GARY N.** Mississippi State University—Temporal scaling of the native-exotic species relationship mediated by microhabitat features and heterogeneity.
- 10:00 65 **GILLIAM, FRANK S.** Department of Biological Sciences, Marshall University, Huntington, WV 25755—Response of the herbaceous layer of forest ecosystems to excess nitrogen deposition.
- 10:15 66 **KUPPINGER, DANE M., PETER S. WHITE, AND MICHAEL A JENKINS.** University of North Carolina at Chapel Hill, University of North Carolina at Chapel Hill, National Park Service, Great Smoky Mountains—Xeric forest seed banks in the Great Smoky Mountains National Park: The presence of the exotic *Paulownia tomentosa* and implications for management.
- 10:30 67 **MARCINKO, SARAH E AND JOHN L RANDALL.** The University of North Carolina at Chapel Hill—Reproductive biology and conservation implications for the federally endangered, *Ptilimnium nodosum* (Apiaceae).
- 10:45 **COFFEE BREAK**
- 11:00 68 **NAPLES, BRENDAN AND MELANY FISK.** Appalachian State University—Fungal responses to localized nutrient heterogeneity in a northern hardwood forest.
- 11:15 69 **SIDES, KATHERINE¹, COLLEEN IVERSEN², AND RICHARD NORBY¹.** Oak Ridge National Laboratory¹ and the University of Tennessee²—Soil carbon efflux and belowground processes under elevated CO₂ and nitrogen fertilization.

- 11:30 70 **HUBER, AMY¹, AMY GASKELL², CHRISTOPHER WORRELL³ LARRY ROGERS³ AND MARTIN CIPOLLINI³**. Miami University of Ohio¹, Stephan Austin University² and Berry College³—Estimation of total biomass in a Mountain Longleaf Pine ecosystem in northwestern Georgia.
- 11:45 71 **HUDSON, SHERI L., MARGARET CIRTAINT, AND SCOTT FRANKLIN**. University of Memphis—Vegetative Propagation of *Arundinaria gigantea*, North America's Only Native Bamboo, Using Cut Culms.

Plant Ecology II Room 8/9

Presiding: Jeff Walck, Middle Tennessee State University

- 8:45 72 **PAGEL, ALISHA L.¹, JAY GARLAND², FRANK P. DAY¹, BRUCE HUNGATE³, J. PATRICK MEGONIGAL⁴, KAREN CARNEY⁴, AND BERT DRAKE⁴**. ¹Old Dominion University, ²Dynamac Corporation, Kennedy Space Center, ³Northern Arizona University, and ⁴Smithsonian Environmental Research Center—Microbial community function altered by elevated atmospheric CO₂ in Florida scrub-oak soil and leaf litter.
- 9:00 73 **ROLIG, MARTA, JEFFREY L. WALCK AND SITI N. HIDAYATI**. Middle Tennessee State University—Effects of herbicides and fertilizers on seed germination of two rare *Paysonia* species (Brassicaceae).
- 9:15 74 **COLE, PATRICE**. The University of Tennessee, Knoxville—The non-native grass, *Microstegium vimineum*, suppresses woody seedling recruitment in understory habitat.
- 9:30 75 **GADD, LAURA AND JON STUCKY**. North Carolina State University—Pollination biology of *Echinacea laevigata* (Boynton and Beadle) Blake, Smooth Coneflower, in small, isolated populations.
- 9:45 76 **LALIBERTE, LORRIE AND JAMES LUKEN**. Coastal Carolina University—Plant distribution along the rims of Carolina bays in Horry County, South Carolina.
- 10:00 77 **MCMILLAN, BRETT A. AND FRANK P. DAY**. Old Dominion University—Determinants of floristic structure on the 'pimple' dunes of Virginia's barrier islands.
- 10:30 78 **MORETZ, C. CRAIG AND MILES R. SILMAN**. Wake Forest University—A three year demographic study on the tropical orchid *Phragmipedium caudatum* in southeastern Peru.
- 10:45 **COFFEE BREAK**
- 11:00 79 **SCARBOROUGH, ANGELA R.** Central Missouri State University—Species assemblages of tree canopy myxomycetes related to bark pH.
- 11:15 80 **STOVER, DANIEL B.¹, FRANK P. DAY¹, JOHN R. BUTNOR² AND BERT G DRAKE³**. Old Dominion University¹, U.S. Forest Service² and Smithsonian Environmental Research Center³—Utilization of ground penetrating radar to quantify the effects of elevated atmospheric CO₂ on coarse root biomass in a scrub oak ecosystem at Kennedy Space Center, FL.

- 11:30 81 **BINKLEY, MEAGAN, KARA ALLEN, DEBORAH MCGRATH AND NATASHA COWIE.** University of the South—The effects of Nepal Grass (*Microstegium vimineum*) on soil ecology on upland sites of southern Cumberland Plateau, Sewanee, Tennessee.
- 11:45 82 **BOLIN, JAY F.¹, LYTTON J MUSSELMAN¹, AND KUSHAN U. TENNAKOON^{1,2}.** Old Dominion University¹ and University of Peradeniya, Sri Lanka²—A report of fruiting; germination, and seedling development of *Arundinaria gigantea* (Walter) Muhl.

Microbiology
Room 10/11

Presiding: Michael Land, Northwestern State University

- 8:30 83 **BRAY, AMANDA, TYLER POOLE, MICHAEL LAND AND FITZROY ORRITT.** Northwestern State University—Methodologies and determination of chemotherapeutic effects on methicillin-resistant *Staphylococcus aureus*.
- 8:45 84 **CHERRY, JAMIE, CODY COLE, MICHAEL LAND AND FITZROY ORRITT.** Northwestern State University—Methodologies and determination of chemotherapeutic effects on pathogenic *Candida spp.*
- 9:00 85 **GREEN, DAVID, JOSH BREITHAUPT AND MICHAEL LAND.** Northwestern State University—Methods to reduce pathogen loads in reptiles using *Anolis carolinensis* as a model organism.
- 9:15 86 **YRLE, FRANK, LUKE STORRS, DANIEL KLUCZNIK AND MICHAEL LAND.** Northwestern State University—Effects of *E. coli* O-157:H7 on *Xeopus* survival.
- 9:30 87 **HORN, CHERYL, KASEY BELVA, SHANNON CAGLE, CRYSTAL HARSANY, KEELY O'BRIEN, KATIE OWENS, NICOLE RUBERTI, AND HENRY SPRATT.** University of Tennessee at Chattanooga—Electrical current generation by soil microbes inoculated with polycyclic aromatic hydrocarbon-exposed sediments.
- 9:45 88 **HETRICK, MARY¹, NITIN WARIER², DIETER KNOWLE², NARA GAVINI¹ AND LAKSHMI PULAKAT¹.** Mississippi State University¹ and Bowling Green State University²—Pertussis toxin mediated inhibition of the angiotensin II receptor AT2 signaling via an independent Gi protein mechanism.
- 10:00 **COFFEE BREAK**
- 10:15 89 **BRANDON, CLARK AND RAJ BOOPATHY.** Nicholls State University—Bioremediation of Explosive Contaminated Soil by Soil Bacteria.

- 10:30 90 **BENNETT, PHILIP, STEPHEN HALES, RON HIGGINS, LISA HUTCHINGS, DON SEDER, and HENRY SPRATT.** University of Tennessee at Chattanooga—Mineralization of the herbicide metolachlor by microbes in urban and rural streams.
- 10:45 91 **CAMPBELL, MATTHEW, INIGO HOWLETT, JOSEPH NIHILL, JACOB SLACK, PETER THORNTON, AND HENRY SPRATT.** University of Tennessee at Chattanooga—The effects of prior exposure and biostimulation on the mineralization of naphthalene from two wetland sites in southeastern Tennessee.
- 11:00 92 **VAN OS, LESLIE, AMANDA CHUDY, STACEY BRYSON, AND JUANITA LEONHARD.** Illinois College—A comparison of the anti-microbial effect of essential oils against Bacteria and fungi of medical significance.
- 11:15 93 **KIRKER, G.T., S.V. DIEHL, AND M.L. PREWITT.** Mississippi State University—Effects of Chlorothalonil (CTN) and Butylated Hydroxy Toluene (BHT) on microbial communities involved in deterioration of wood using T-RFLP.
- 11:30 94 **NAHAR, PRANJAL, KEVIN FLINN, AND CHRISTI MAGRATH.** Troy University—A transcription termination profile of the autonomous replication sequences from Chromosome III of *Saccharomyces cerevisiae*.

THURSDAY, MARCH 30, 2006

AFTERNOON SESSION

All Taxa Biodiversity Inventory Symposium II: A Search For Species In Our Own “Backyard” Tennessee Ballroom C

Presiding: Ben Cash, Maryville College

- 1:30 95 **WAGNER, DAVID¹ AND BRIAN SCHOLTENS².** University of Connecticut¹ and College of Charleston²—Our journey through the Lepidoptera of Great Smoky Mountains National Park.
- 1:45 96 **SANDERS, NATHAN¹, ROBERT DUNN², JEAN-PHILIPPE LESSARD¹, MELISSA GERAGHTY¹.** University of Tennessee, Knoxville¹ and North Carolina State University²— Spatial diversity of forest ants in Great Smoky Mountains National Park, USA
- 2:00 97 **MAYOR, ADRIEAN.** GSMNP—Native bees (Hymenoptera: Apoidea) of the GSMNP.
- 2:15 98 **LANGDON, KEITH.** GSMNP—Dragon and Damsel Flies of the Smokies.
- 2:30 99 **CLEBSCH, EDWARD and JAMES COKENDOLPER**—University of Tennessee and Lubbock, TX—"Pseudoscorpions of the Smokies—an introduction."

- 2:45 100 **WATTERS, G. THOMAS¹ AND DAN C. DOURSON².** Ohio State University¹ and Stanton, KY²—Land snail surveys of the Great Smoky Mountains National Park.
- 3:00 **COFFEE BREAK**
- 3:15 101 **PETERSEN MATTHEW J., AND JESSICA D. DAVIS.** Iowa State University—Influence of Abiotic Factors on a Southern Appalachian Crane fly (Diptera; Tipulidae) fauna.
- 3:30 102 **NELSON, DIANE AND PAUL BARTLES.** East Tennessee State University and Warren Wilson College—Smoky Bears: Tardigrada of the Great Smoky Mountains National Park.
- 3:45 103 **CASH, W.B.¹, JAY CLARK², FRANK van MANEN², JESSICA DANIEL³, JON DAVENPORT⁴, JOSHUA ENNEN⁵, JAMES RAMSEY³ AND JAMES WEBB¹.** Maryville College¹, University of Tennessee², Murray State University³, East Carolina University⁴ and University of Southern Mississippi⁵—Reptile richness of Great Smoky Mountains National Park.
- 4:00 104 **SIMONS, THEODORE, R.¹ AND SUSAN A. SHRINER².** USGS Cooperative Research Unit, North Carolina State University¹ and Colorado State University²—Breeding bird Inventories in Great Smoky Mountains National Park - links to research and monitoring.
- 4:15 105 **PIVORUN, EDWARD B.** Clemson University—Small mammal population dynamics within the ATBI sites of the GSMNP.
- 4:30 106 **LANDOLT, JOHN C.¹ AND STEVEN L. STEPHENSON².** Shepherd University¹ and University of Arkansas²—Mycetozoans of the Great Smoky Mountains National Park.
- 4:45 Closing remarks by **PETER WHITE**, Chairman of the Board of DLIA followed by a Discussion.

Plant Systematics I
Tennessee Ballroom D

Presiding: John Nelson, University of South Carolina

- 1:30 107 **REMBERT, DAVID H*.¹, PALMER E. KRANTZ², AND JOHN B. NELSON¹.** University of South Carolina¹ and Riverbanks Zoo and Garden²—The vegetation and natural history of Bomb Island, South Carolina.
- 1:45 108 **DARR, ANN R*.¹, ALBERT B. PITTMAN² AND KATHY A. BOYLE².** A.C. Moore Herbarium, University of South Carolina¹ and South Carolina Heritage Trust Program²—Botanical Survey of Marl, Limestone, and Chert Formations in South Carolina.

- 2:00 109 **BRADBURY, E. JANE^{*1}, JOHN B. NELSON¹, AND ANN DARR².** University of South Carolina¹ and South Carolina Department of Natural Resources²—Vascular plant inventory of Congaree Bluffs Heritage Preserve.
- 2:15 110 **BARRON, JENNIFER*, AMANDA BRIANT, BRITTNEY DENIER CANTRELL, GINA CHILDERS, MICHELLE CLIFTON, SARAH GOWDER, RENEE VAN CLEAVE, AND MICHAEL WAYNE MORRIS.** North Georgia College & State University—A floristic study of Ramblewood, Lumpkin County, Georgia.
- 2:30 111 **NELSON, JOHN B.** University of South Carolina—The Jepson Manual, and the hedge-nettles (*Stachys*, Lamiaceae) of California.
- 2:45 112 **JOHNSON, GEORGE. P.** Arkansas Tech University—The Orchidaceae in Arkansas.
- 3:00 113 **GENTRY, JOHNNIE L.*¹, GEORGE P. JOHNSON², SARAH C. NUNN¹, ERIC SUNDELL³, AND C. THEO WITSELL⁴.** University of Arkansas¹, Arkansas Tech University², University of Arkansas at Monticello³, and Arkansas Natural Heritage Commission⁴—The Arkansas Vascular Flora Project: The Flora, the Royal Rubi, and on Golden Pond.
- 3:15 **COFFEE BREAK**
- 3:30 114 **ESTES, DWAYNE.** University of Tennessee—The vascular flora of Giles County, Tennessee.
- 3:45 115 **ESTES, DWAYNE.** University of Tennessee—A new narrowly endemic species of *Clematis* (Ranunculaceae; subgenus *Viorna*) from northeastern Texas.
- 4:00 116 **POINDEXTER, DERICK B*, ZACK E. MURRELL, AND GARY L. WALKER.** Appalachian State University—The preliminary vascular flora of Mount Jefferson State Natural Area and environs.
- 4:15 117 **McMULLEN, CONLEY K*. AND ANDREA WEEKS.** James Madison University and George Mason University—A taxonomic revision of the endemic members of *Cordia* (Boraginaceae) in the Galápagos Islands – preliminary results.
- 4:30 118 **JONES, RONALD L.** Eastern Kentucky University—Additions and corrections for the first printing of *Plant Life of Kentucky*, and an updated checklist of the vascular flora.
- 4:45 119 **JONES, RONALD L.** Eastern Kentucky University—A history of floristic botany in Kentucky.
- 5:00 120 **MELLICHAMP, T. LAWRENCE.** University of North Carolina at Charlotte—A history of pictures of pitchers (*Sarracenia*).

Southeastern Society of Parasitologists II
Gatlinburg A**Presiding: Michael Yabsley, University of Georgia**

- 1:30 121 **MURPHY, STACI M.¹, MICHAEL J. YABSLEY¹, M. PAGE LUTTRELL¹, DAVID E. STALLKNECHT¹, AND SUSAN E. LITTLE².** Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia¹ and Department of Pathobiology, College of Veterinary Medicine, Center for Veterinary Health Sciences, Oklahoma State University²—Experimental inoculation of raccoons (*Procyon lotor*) with *Anaplasma phagocytophilum*, *Ehrlichia chaffeensis*, *Ehrlichia canis*, *Ehrlichia ewingii*, and *Borrelia lonestari*.
- 1:45 122 **ESLICK, RENÉ M. and VINCENT A. CONNORS.** University of South Carolina Upstate—Production of the reactive oxygen species, superoxide, by cells from the *Biomphalaria glabrata* (Pulmonata) embryonic cell line.
- 2:00 123 **MINTER, JENNIFER AND EDWIN ROWLAND.** Ohio University—Fate of intracellular *Trypanosoma cruzi* inhibited from egressing the host cell.
- 2:15 124 **HARTMAN, ANGELA¹, ROBERT C. WILLIAMS¹, ALEXA C. ROSYPAL² AND DAVID S. LINDSAY¹.** Virginia Tech¹ and University of North Carolina Chapel Hill²—Efficacy of the FTA-filter based method to detect DNA of *Cryptosporidium parvum* and *Toxoplasma gondii* from oocysts.
- 2:30 125 **MITCHELL, SHEILA M., ANNE M. ZAJAC, AND DAVID S. LINDSAY.** Virginia Tech—Development of *Cystoisospora canis* in cell culture: Evidence for unizoic cyst formation in vitro.
- 2:45 126 **CASSELL, MEREDITH¹, JEANNINE S. STROBL², CHRIS REILLY², AND DAVID S. LINDSAY¹.** Virginia Tech¹ and Virginia College of Osteopathic Medicine²—Efficacy of histone deacetylase inhibitors against *Toxoplasma gondii*.
- 3:00 127 **GAJI, RAJSHEKHAR Y. AND DANIEL K. HOWE.** Department of Veterinary Science, University Of Kentucky, Lexington, KY—GAGACGC is a critical cis-acting element required for *SnSAG1* gene expression in *Sarcocystis neurona*.
- 3:15 **COFFEE BREAK**
- 3:30 204 **STOCKDALE, HEATHER D.¹, G. SHANE WEST², TED HANKES³, KENNETH L. MCMILLAN⁴, MARK WHITLEY⁵, CHRISTINE C. DYKSTRA¹, JENNIFER A. SPENCER¹ AND BYRON L. BLAGBURN¹** Auburn University College of Veterinary Medicine¹, Vestavia Animal Clinic, Birmingham, AL², Alford Animal Veterinary Hospital, Birmingham, AL³, Pell City Animal Hospital, Cropwell, AL⁴, and Cobb Animal Clinic, Greensboro, NC⁵—*Tritrichomonas foetus* induced large-bowel diarrhea is an emerging disease in domestic cats.

- 3:45 199 **CARREÑO, ABIGAIL D.¹, A. RICK ALLEMAN², ANTHONY F. BARBET², GUY H. PALMER³, SUSAN M. NOH³ AND CALVIN M. JOHNSON¹.** Department of Pathobiology, Auburn University¹; Department of Pathobiology, University of Florida²; and Department of Veterinary Microbiology and Pathology, Washington State University³—*In vivo* endothelial cell infection by *Anaplasma marginale*.
- 4:00 203 **ROSYPAL, ALEXA C.^{1,2}, DWIGHT D. BOWMAN³, DANIEL HOLLIMAN¹, GEORGE J. FLICK¹, AND DAVID S. LINDSAY¹.** Virginia Tech¹, University of North Carolina at Chapel Hill², Cornell University³—Effects of high hydrostatic pressure processing on *Ascaris suum* eggs.

Teaching Biology Room 2/3

Presiding: John Aliff, Georgia Perimeter College

- 1:30 131 **BEASLEY, RODNEY, DARREL SCHMITZ, CHARLES WAX, AND BURNETT HAMIL.** Mississippi State University—I will be fearless as a teacher: a peer teaching exercise using Rachel Carson's book Silent Spring.
- 1:45 132 **EZELL, WM. BRUCE.** University of North Carolina at Pembroke—Using Stories in the Teaching of Non-Major Biology Classes
- 2:00 133 **HELD, MICHAEL E.** Saint Peter's College—Case studies, scientific literacy and the non-major science course.
- 2:15 134 **ALIFF, JOHN VINCENT.** Georgia Perimeter College, Gwinnett University Center—Dealing with student perceptions of the nature of science.
- 2:30 135 **EZELL, WM. BRUCE.** University of North Carolina at Pembroke—Evolution in Public Education: the Role of the Professional Biologist ...Splendid Isolation or Creative Engagement?
- 2:45 136 **HERTZ, PAUL E.** Barnard College, New York, USA—Reaching the 21st Century Student.
- 3:00 136 **HERTZ, PAUL E.** Barnard College, New York, USA—Reaching the 21st Century Student, continued.

Invertebrate Zoology and Entomology Room 4/5

Presiding: Robert W. VanDevender

- 1:30 137 **HENDRIXSON, BRENT E. AND JASON E. BOND.** East Carolina University—Molecular phylogeny of the spider genera *Antrodiaetus* and *Atypoides* (Araneae: Mygalomorphae:Antrodiatidae).
- 1:45 138 **DAFOE, ROBERT AND FRANK A. ROMANO.** Jacksonville State University—Preliminary results of a leaf litter tardigrade survey on Dauphin Island, Alabama.

- 2:00 139 **DIMOCK, RONALD V., JR.** Wake Forest University—Siphons on demand: not all bivalve molluscs have fused-mantle plumbing to separate inhalant and exhalant flow.
- 2:15 140 **NIX, E. ASHBY¹, MICHAEL K. MOORE^{1,2}, VICTOR W. TOWNSEND³, JR., BART KIMBRELL², AND BLAKE KIMBRELL².** ¹Department of Environmental Science and ²Biology, Mercer University, Macon, GA 31207, ³Department of Biology, Virginia Wesleyan College, Norfolk, VA—Animal diversity and community structure in phytotelmata of *Heliconia aurea* from Trinidad, W. I.
- 2:30 141 **PHILLIPS, ANNA J. AND ROBERT WAYNE VAN DEVENDER.** Appalachian State University—Preliminary survey of the leeches of Cat Tien National Park, Dong Nai Province, Vietnam.
- 2:45 142 **PHILLIPS, ANNA J.¹ AND MARK E. SIDDALL².** Appalachian State University¹ and American Museum of Natural History²—Phylogeny of the New World medicinal leech family Macrobdellidae (Oligochaeta: Hirudinida: Arhynchobdellida).
- 3:00 **COFFEE BREAK**
- 3:15 143 **PROUD, DANIEL N.¹, VICTOR R. TOWNSEND, JR¹, AND MICHAEL K. MOORE².** Virginia Wesleyan College¹ and Mercer University²—Use of logs, palm fronds, and bromeliads by arachnids in montane rainforests of Trinidad, W. I.
- 3:30 144 **AL-ZEIN, MOHAMMAD S.¹ and KHOUZAMA M. KNIO².** Old Dominion University¹ and American University of Beirut²—Comparative life history and behavioral studies of two cryptic and sympatric *Chaetostomella* species (Diptera: Tephritidae).
- 3:45 145 **MAREK, PAUL E. AND JASON E. BOND.** East Carolina University—Systematics and color mimicry evolution of cyanide-producing millipedes of Appalachia (Polydesmida, Xystodesmidae, Apheloriini).
- 4:00 146 **ODOM, C. BRIAN.** Wingate University—A novel method for the collection of non-alate ants from colonies of the Red Imported Fire Ant, *Solenopsis invicta* (Buren).
- 4:15 147 **BROWN, CHRISTOPHER G. AND DANIEL J. FUNK.** Vanderbilt University—Fecal-case associated behavior and life history of *Neochlamisus* leaf beetles.
- 4:30 148 **GARRIS, HEATH W. AND JOHN A. SNYDER.** Furman University—Sex-specific attraction of Southeastern United States moth populations to ultraviolet light.
- 4:45 149 **STOCKMAN, AMY K. AND JASON E. BOND.** East Carolina University—Extreme population structuring on a micro-geographic scale in Californian trapdoor spiders.

Plant Ecology III
Room 6/7

Presiding: Patrice Cole, University of Tennessee

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| 1:30 | 150 | GRAHAM, JAMES R., GARY WALKER, RAY WILLIAMS, ZACK MURRELL, AND ART REX. Appalachian State University— <i>Tsuga canadensis</i> ecosystems and spatial patterns of <i>Adelges tsugae</i> infestation in northwestern North Carolina. |
| 1:45 | 151 | JOHNSON, SARAH. E.¹ AND CLAUDIA L. JOLLS². ¹ University of Wisconsin-Madison, ² East Carolina University, North Carolina—An assessment of the role of competition on the beach as a factor in the distribution of <i>Amaranthus pumilus</i> Raf. (Amaranthaceae). |
| 2:00 | 152 | KUTOSKY, WILLIAM¹, KRIS McDONALD¹, SARAH POULTER^{1,2}, AND LAWRENCE ZETTLER¹. Orchid Recovery Program, Illinois College ¹ and Southern Illinois University ² —Conservation-driven seed propagation and reintroduction of <i>Epidendrum nocturnum</i> (Orchidaceae) with a mycorrhizal fungus. |
| 2:15 | 153 | STRAHL, MAYA, MARTIN CIPOLLINI, RICHARD WARE AND PATRICIA TOMLINSON. Berry College—Vegetation survey of Martha's Meadow, a calcareous limestone glade habitat. |
| 2:30 | 154 | WANG, WEI¹, SCOTT B. FRANKLIN¹ and JOHN R. OUELLETTE². University of Memphis ¹ and Memphis Zoo ² —Characteristics of a flowering event of an arrow bamboo <i>Fargesia qinlingensis</i> . |
| 2:45 | 155 | BATTAGLIA, LORETTA L.¹ AND WILLIAM J. PLATT². Southern Illinois University Carbondale ¹ and Louisiana State University ² —Disassembly and reassembly of coastal plant communities: the role of abiotic and biotic filters in invasion resistance to seaward and landward migrations. |
| 3:00 | <u>COFFEE BREAK</u> | |
| 3:15 | 156 | COOK, REBECCA A.¹ AND PATRICIA D. PARR². Lambuth University ¹ and Oak Ridge National Laboratory ² —Long term monitoring of a population of <i>Delphinium exaltatum</i> Ait. |
| 3:30 | 157 | FOWLER, KADRIN E. and JAY F. BOLIN. Old Dominion University—The role of smoked water in seed germination of <i>Pyxidanthera barbulata</i> (Diapensiaceae). |
| 3:45 | 158 | HUPP, CLIFF R.¹ AND MASSIMO RINALDI². U.S. Geological Survey ¹ and University of Florence ² —Riparian vegetation patterns in relation to fluvial landforms and channel evolution along selected rivers of Tuscany. |
| 4:00 | 159 | PARAJULI SHANTA¹, YONG WANG¹, WUBISHET TADESCSE¹, AND CALLIE J. SCHWEITZER². Alabama A&M University ¹ and USDA Forest Service, Southern Research Station ² —Forest site classification of northeastern Alabama using remote sensing and geographic information system. |

- 4:15 160 **REINHARDT, KEITH AND DAN JOHNSON AND BILL SMITH.** Wake Forest University—Ecophysiology of broad-leaved treeline species in the Caucasus Mountains of Georgia.
- 4:30 161 **SHARITZ, REBECCA, KATHRYN MADDEN AND DON IMM.** Savannah River Ecology Laboratory—Habitat characteristics of TES plants of the southeastern Fall Line sandhills region
- 4:45 162 **WELCH¹, NICOLE TURRILL, DWAYNE E. COLEMAN¹ AND CHRISTOPHER G. MEYER².** ¹Middle Tennessee State University and ²University of Southern California—The chemical influence of *Kalmia latifolia* on *Pinus pungens* seedlings.

Plant Ecology IV
Room 8/9

Presiding: Theresa Pitts-Singer, Utah State University

- 1:30 163 **DE STEVEN, DIANE¹, REBECCA R. SHARITZ², AND CHRISTOPHER D. BARTON³.** USDA Forest Service Southern Research Station¹, Savannah River Ecology Laboratory², and University of Kentucky³—Results from experimental restorations of coastal plain depression wetlands.
- 1:45 164 **JOHNSON, DANIEL M. AND WILLIAM K. SMITH.** Wake Forest University—Effects of cloud immersion on understory light environment and photosynthesis in the southern Appalachian Mountains (USA).
- 2:00 165 **MORROW, CHRIS AND DANNY J. GUSTAFSON.** The Citadel—Does physiological integration among *Spartina alterniflora* ramets reduce the negative effects of grazers?
- 2:15 166 **REYNOLDS, LAUREN¹, NICHOLAS MCLETCHIE¹, AND LLOYD STARK².** University of Kentucky¹ and University of Nevada, Las Vegas²—Morphological and physiological differences along an environment gradient in a desert moss.
- 2:30 167 **WYATT, JULIE L. AND MILES R. SILMAN.** Wake Forest University—Spatial and temporal patterns of the herbaceous layer due to logging history in Southern Appalachian cove forests.
- 2:45 168 **CUMMINGS, JUSTIN AND STEVE OBERBAUER.** Eastern Illinois University and Florida International University—Photosynthetic response to leaf temperature regime of tropical plants.
- 3:00 **COFFEE BREAK**
- 3:15 169 **BOLTZ, SARAH K. AND LYTTON MUSSELMAN.** Old Dominion University—Morphology and population structure of heartleaves, *Hexastylis virginica* (Aristolochiaceae), in southeastern Virginia.

- 3:30 170 **CURRIE, KATE¹, J. MORGAN VARNER², JOHN KUSH³ AND MARTIN CIOLLINI⁴.** Rose Hulman College¹, Humboldt State University², Auburn School of Forestry and Wildlife Sciences³, and Berry College⁴—A survey of the herbaceous vegetation in the Berry College Longleaf Pine Management Area.
- 3:45 171 **ENGEL, E. CAYENNE¹, JAKE F. WELTZIN¹, AND RICHARD J. NORBY².** University of Tennessee, Knoxville¹ and Oak Ridge National Laboratory Environmental Sciences Division²—Interactive effects of warming and water availability on NDVI in an old-field community global change experiment.
- 4:00 172 **GERSCHUTZ, ANDREW D.** University of North Carolina, Chapel Hill—A comparison of niche and neutral theory in old-growth and second-growth hemlock forests.
- 4:15 173 **McDONALD, KRIS¹, SARAH HOPKINS^{1,2}, STEVE PERLMAN³ AND LAWRENCE ZETTLER¹.** Orchid Recovery Program, Illinois College¹, University of Alaska-Fairbanks², National Tropical Botanical Garden³—The status and propagation of the Federally endangered Hawaiian endemic, *Platanthera holochila* (Orchidaceae).
- 4:30 174 **PITTS-SINGER, THERESA L.¹ AND JOAN L. WALKER².** USDA-ARS Bee Biology & Systematics Laboratory¹ and USDA Forest Service Southern Research Station²—Through the eyes of a bee-holder: a look at rare plants of Apalachicola National Forest, FL

FRIDAY, MARCH 30, 2006

MORNING SESSION

Plant Systematics II Tennessee Ballroom C

Presiding: Rebecca Bray, Old Dominion University

- 8:30 175 **GILLESPIE, EMILY L, CATHERINE M BUSH AND KATHLEEN A KRON.** Wake Forest University—Phylogenetic relationships among major clades of Ericoideae (Ericaceae) based on multiple molecular markers.
- 8:45 176 **BECK, JOHN AND RANDALL SMALL.** University of Tennessee—Phylogenetic history of *Sida* and related genera (Malvaceae) based on chloroplast and nuclear DNA sequences.
- 9:00 177 **MORRIS, ASHLEY B.^{1,2}, ALEXANDRA R. BIGGER^{1,2}, ZERA S. DAMJI^{1,2}, DOUGLAS E. SOLTIS¹, AND PAMELA S. SOLTIS^{1,2}.** Department of Botany, University of Florida and Florida Museum of Natural History, University of Florida—Finding refuge in eastern North America: Phylogeographic patterns in American beech and sweetgum.
- 9:15 178 **MATHEWS, KATHY AND ADAM GRIFFITH.** Western Carolina University—The relationships of phylogeny and distribution patterns in *Sabatia* (Gentianaceae).

- 9:30 179 **FARMER, SUSAN B. AND E. E. SCHILLING.** University of Tennessee—Status of the *Trillium pusillum* species complex.
- 9:45 180 **NOBLE, SARAH MARIE AND JUAN LOPEZ-BAUTISTA.** The University of Alabama—*Cephaleuros virescens*: a wide-spread subaerial green alga (Chlorophyta, Ulvophyceae) from tropical and subtropical regions.
- 10:00 **COFFEE BREAK**
- 10:15 181 **AL-ZEIN, MOHAMMAD S. AND W. CARL TAYLOR.** Old Dominion University—A phylogeny of the endemic quillwort *Isoetes tennesseensis* using the second intron of a *LFY* homolog.
- 10:30 182 **TAYLOR, W. CARL.** Department of Biological Sciences, Old Dominion University—Phylogeny of *Isoëtes Xaltonharvillii* and *I. appalachiana* as revealed by the second intron of a *LFY* homolog.
- 10:45 183 **ALARID, KHALID M., REBECCA D. BRAY, AND W. CARL TAYLOR.** Old Dominion University—The effect of interspecific hybridization and chromosome doubling on spore morphology, orbicule typology, and intercellular pectic protuberances in *Isoetes*.
- 11:00 184 **BRAY, REBECCA D. AND W. CARL TAYLOR.** Old Dominion University—Does morphology mirror molecular data in *Isoetes appalachiana* and *Isoetes Xaltonharvillii* (Isoetaceae).

Animal Ecology
Tennessee Ballroom D

Presiding: Kim Tolson, University of Louisiana, Monroe

- 8:30 185 **FITZPATRICK, MATTHEW¹, JAKE F. WELTZIN¹, NATHAN J. SANDERS¹, AND ROBERT R. DUNN².** ¹University of Tennessee and ²North Carolina State University—The biogeography of prediction error: why does the introduced range of the fire ant over-predict its native range?
- 8:45 186 **VILLALPANDO, SHAWN and RAY S. WILLIAMS.** Appalachian State University—Insect community responses to simultaneous CO₂, temperature, and moisture treatments within an old-field ecosystem.
- 9:00 187 **PARADISE, CHRISTOPHER¹, LESLIE SMITH¹, JESSICA CARLSON¹, CHARLIE CHRISAWN¹, AND GRACE METZ².** Davidson College¹ and Siena Heights University²—Top-down and bottom-up factors: which is more important in regulating diversity in treehole communities?
- 9:15 188 **MARBERT BRYAN S¹, RAY S WILLIAMS, AND PAUL J HANSON².** APPALACHIAN STATE UNIVERSITY¹ AND OAK RIDGE NATIONAL LABORATORY²—Ground-dwelling arthropods as indicators of change in forest floor processes due to long-term precipitation alteration.
- 9:30 189 **BHATTARAI, SAMEER AND MICHAEL W. MULLEN.** Troy University—Large woody debris and its influence on macroinvertebrate assemblages in southeastern coastal plain streams, USA.

- 9:45 190 **HITT, NATHANIEL¹ AND PAUL ANGERMEIER².** Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University^{1,2} and Virginia Cooperative Fish and Wildlife Research Unit²—Effects of stream topology on fish assemblage structure in the mid-Atlantic highlands.
- 10:00 **COFFEE BREAK**
- 10:15 191 **GREENBERG¹, CATHRYN H., AIMEE L. TOMCHO^{1,2}, J. DREW LANHAM², THOMAS WALDROP¹, J. TOMCHO³, AND DEAN SIMON³.** USDA Forest Service, Southern Research Station¹; Clemson University, Department of Forest Resources²; North Carolina Wildlife Resources Commission³—Effect of fuel reduction treatments on southern Appalachian breeding birds.
- 10:30 192 **MOORE, DEBBIE¹ AND W. SEAN SANDERS².** Troy University Dothan Campus¹ and Houston County High School²—A Preliminary Survey of Chiropterans Utilizing Bridges, Culverts and Drain Pipes Found in the Wiregrass Area.
- 10:45 193 **JONES, CHRISTOPHER M. AND WADE B. WORTHEN.** Furman University—Relationships between morphology and perch height preference in a guild of summer dragonflies.
- 11:00 194 **OLSZAK, JASON D. AND KIM MARIE TOLSON.** University of Louisiana Monroe—A description of small mammal communities in a managed bottomland hardwood forest.

Southeastern Society of Parasitologists III
Gatlinburg A

Presiding: Sharon Patton, University of Tennessee

- 8:30 195 **DOFFITT, CYNTHIA M.¹, LINDA M. POTE¹, AND D. TOMMY KING².** Mississippi State University¹ and USDA/APHIS/WS²—Morphological comparison and identification of cercariae released by the rams-horn snail *Planorbella trivolvis*.
- 8:45 196 **GRINSTEAD, C. BRAD¹, OSCAR J. PUNG¹ AND KRAIG KERSTEN².** Georgia Southern University¹ and Armstrong Atlantic State University²—Distribution of hydrobiid snails and their parasites in salt marsh along the Skidaway River in coastal Georgia.
- 9:00 197 **BURON, ISAURE DE¹ AND WILLIAM A. ROUMILLAT².** Biology Department, College of Charleston, SC¹ and Inshore Fisheries Section, Marine Resources Research Institute, South Carolina Department of Natural Resources²—Histopathology of philometrid nematodes in the southern flounder *Paralichthys lethostigma*.
- 9:15 198 **FULLER, CLAIRE A.** Murray State University—The relationship between the abiotic environment and the immune function of the Caribbean termite, *Nasutitermes acajutlae*.

- 9:30 128 **STIEVE, ERICA¹, KIMBERLEE BECKMEN², AND SHARON PATTON.¹** University of Tennessee College of Veterinary Medicine¹ and Alaska Department of Fish and Game²—Seroprevalence of *Neospora spp.* and *Toxoplasma gondii* in caribou, moose, wolf, and fox populations in Alaska.
- 9:45 200 **AHN, JUN, JOSHUA ELLIS, DAAIYAH COOPER, HALEY JACKSON, DANA DARMOHRAY, AND ALAN F. SMITH.** Department of Biology, Mercer University, Macon, GA 31207—Detection of the causative agents of Lyme disease and ehrlichiosis in individual southern black-legged ticks collected from white-tailed deer of the Piedmont National Wildlife Refuge.
- 10:00 **COFFEE BREAK**
- 10:15 201 **YABSLEY, MICHAEL J.¹, THIERRY M. WORK², AND ROBERT A. RAMEYER².** Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, Georgia¹ and U.S. Geological Survey, National Wildlife Health Center, Honolulu Field Station, Honolulu Hawaii²—Molecular phylogeny of *Babesia poeleea* from brown boobies (*Sula leucogaster*) from Johnston Atoll, Central Pacific.
- 10:30 202 **PALMIERI, JAMES R., Ph.D¹, KATHERINE BARTER, BS, MT², MELISSA HRICKO, BS³ AND MARIE PALLOTT⁴.** Department of Microbiology, Division of Biomedical Sciences, Virginia College of Osteopathic Medicine¹, Virginia Polytechnic Institute Department of Biochemistry^{2,4} and Center for Molecular Medicine and Infectious Diseases Virginia Maryland Regional College of Veterinary Medicine^{1,2,4} and Virginia Commonwealth University, Department of Clinical Laboratory Science, Richmond VA³—Low temperature induction of *Acanthamoebae* trophozoites from dormant cysts influences their ability to phagocytize bacteria.
- 10:45 129 **STONE, SHARON¹, VINA DIDERRICH-FAULKNER², PAUL E. SUPER³ AND, CHARLES T. FAULKNER¹.** University of Tennessee College of Veterinary Medicine, Knoxville TN¹, Lincoln Memorial University, Harrogate TN², and Great Smoky Mountains National Park, Lake Junaluska, NC³—Endoparasitic Infections in Migratory Birds from the 2003-2005 Banding Seasons at the Purchase Knob, Great Smoky Mountains National Park, Lake Junaluska, NC.
- 11:00 130 **DIDERRICH-FAULKNER, VINA¹, LEAH ALLEN¹, CHARLES T. FAULKNER², AND PAUL E. SUPER³.** Lincoln Memorial University, Harrogate TN¹, and University of Tennessee College of Veterinary Medicine, Knoxville TN², and Great Smoky Mountains National Park, Lake Junaluska, NC³—Patterns of positivity: Endoparasitic infection and host behaviors and in migratory birds from the 2005 banding seasons at the Purchase Knob, Great Smoky Mountains National Park, Lake Junaluska, NC.

Plant Biology
Room 2/3

Presiding: Lytton J. Musselman, Old Dominion University

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| 9:00 | 205 | WILSON, K. G., D. A. FRANCKO, M. A. LOKUGE, LI LU, B. STRENG, M. OSMAN, and C. LEARY-ELDERKIN. Miami University—Zygotic embryos from palms as a research tool. |
| 9:15 | 206 | AL-ZEIN, MOHAMMAD S., KHALID M. ALARID, KUSHAN U. TENNAKOON AND LYTTON J. MUSSELMAN. Old Dominion University—Floral development and style ontogeny in <i>Michauxia campanuloides</i> L'Hér. (Campanuloideae: Campanulaceae). |
| 9:30 | 207 | WILLIAMS, JOSEPH H. University of Tennessee, Knoxville—Evolution of the progamic phase in flowering plants. |
| 9:45 | 208 | ARIAS, TATIANA. University of Tennessee—Architectural analysis of <i>Vismia baccifera</i> (roots and shoots) and <i>Vismia macrophylla</i> (roots) (Clusiaceae). |
| 10:00 | 209 | TENNAKOON, KUSHAN U.^{1,2}, JAY F. BOLIN¹ AND LYTTON J. MUSSELMAN¹, Department of Biological Sciences, Old Dominion University, Norfolk, VA 23529 ¹ and Department of Botany, University of Peradeniya, Sri Lanka ² — <i>Hydnora - Euphorbia</i> association: a model to investigate osmotic relationships of parasitic plants. |
| 10:15 | 210 | FRANCKO, DAVID, KENNETH WILSON, CATHLENE LEARY-ELDERKIN, CASI THOMPSON, AND MUNA OSMAN —A putative new cultivar of <i>Musa basjoo</i> (Japanese fiber banana) for general landscape use. |

Herpetology
Room 4/5

Presiding: Karen Davis, University of Tennessee, Knoxville

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| 8:30 | 211 | PRICE, STEVEN J., JOY M. HESTER, AND MICHAEL E. DORCAS. Davidson College—Habitat use of resident and relocated eastern box turtles. |
| 8:45 | 212 | GOOD, CELESTE D.¹, THOMAS K. PAULEY¹ AND PATRICK KEYSER². Marshall University ¹ and MeadWestvaco Corporation ² —Constructed ponds as mitigated habitat for Wood Frogs (<i>Rana sylvatica</i>) and Spotted Salamanders (<i>Ambystoma maculatum</i>) |
| 9:00 | 213 | KAYLOR, S. DOUG AND THOMAS K. PAULEY. Marshall University—Ecology of Ambystomatidae salamanders in an ephemeral wetland in Mason County, WV. |
| 9:15 | 214 | HAENEL, GREGORY J., ALEX GUESS AND GLENN BUTERA. Elon University—Enrichment of lizard DNA libraries for microsatellite sequences: wash away your troubles. |

- 9:30 215 **DAVIS, KAREN M.** University of Tennessee Knoxville—Emydid turtles exhibit social behavior in a naturalistic setting.
- 9:45 216 **MCGUIRE, SAMUAL B. AND GREGORY J. HAENEL** Elon University—Hybridization between two lizard species, *Urosaurus graciosus* and *Urosaurus ornatus*: evidence from mitochondrial DNA and morphology.
- 10:00 217 **VIERNUM, SARA E. AND GEORGE R. CLINE.** Jacksonville State University—Crevice use by salamanders in northeastern Alabama with an emphasis on the green salamander, *Aneides aeneus*.
- 10:15 **COFFEE BREAK**
- 10:30 218 **BRENT, THOMAS R.** University of South Carolina Upstate—Sampling methods for studies of freshwater turtles: does methodology influence our estimates of abundance, richness, and diversity?
- 10:45 219 **SUTTON, WILLIAM B.¹, YONG WANG¹, AND CALLIE J. SCHWEITZER².** Alabama A&M University¹, USDA Forest Service²—Amphibian and reptile habitat relationships in forest stands scheduled for disturbance: pre-treatment results.
- 11:00 220 **WEBB, CLIFFORD J. AND CLINE, GEORGE.** Jacksonville State University—Habitat Use by Plethodontid salamanders in Northeast Alabama.

Animal Biology and Physiology
Room 6/7

Presiding: Erin Gilliam, University of Tennessee, Knoxville

- 8:30 221 **QUINN, JOHN AND KIM MARIE TOLSON.** University of Louisiana at Monroe—Mechanisms of parasitic egg rejection in two members of the family Mimidae.
- 8:45 222 **HAYES, LOREN¹, ADRIAN CHESH¹, and LUIS EBENSPERGER².** University of Louisiana at Monroe¹ and P. Universidad Católica de Chile²—Functional significance and fitness consequences of group-living in *Octodon degus*.
- 9:00 223 **GILLAM, ERIN H and GARY F MCCRACKEN.** University of Tennessee—Intraspecific variation in the echolocation calls of Brazilian free-tailed bats, *Tadarida brasiliensis*.
- 9:15 224 **SMITH, JAMES H. Jr., SUSAN MORGAN, GERHARD W. KALMUS and JEAN-LUC SCEMAMA.** East Carolina University, Department of Biology, Greenville, N.C., 27858—Developmental gene expression during Caco-2 cell differentiation.
- 9:30 225 **KING, JUDY A., DIEGO F. ALVAREZ, AND MARY I. TOWNSLEY.** University of South Alabama, Mobile, Alabama—Correlative microscopic analysis of pulmonary endothelial leak sites.

- 9:45 226 **TUBERTY, SHEA R.¹ AND CHARLES L. MCKENNEY, JR².** Appalachian State University¹ and U.S. Environmental Protection Agency²—Ecdysteroid responses of estuarine crustaceans exposed through complete larval development to juvenile hormone agonist insecticides.

10:00 **COFFEE BREAK**

Ornithology
Room 6/7

Presiding: Paul Super, National Park Service

- 10:15 227 **SUPER, PAUL E. ¹, LES SAUCIER¹ AND CHARLIE MUISE².** Appalachian Highlands Science Learning Center of the National Park Service¹ and Great Smoky Mountains Institute²—A Bird in the hand: optimizing the data and educational value of captured birds in Great Smoky Mountains National Park.
- 10:30 228 **CARPENTER, JOHN P.¹, YONG WANG¹, AND CALLIE J. SCHWEITZER².** Alabama A&M University¹ and USDA US Forest Service²—Status of the Cerulean Warbler in northern Alabama: Current population estimates and habitat characteristics.
- 10:45 229 **WICK, JILL M. AND YONG WANG.** Alabama A&M University—Breeding bird communities of pine-hardwood forests in Bankhead National Forest, AL.
- 11:00 230 **PEARSON, SCOTT M. AND ALAN B. SMITH.** Mars Hill College—Composition of breeding bird communities along the Blue Ridge Parkway.

Plant Ecology V
Room 8/9

Presiding: Christopher Adams, Shorter College

- 9:00 231 **REILLY, CAROLYN D., JAKE F. WELTZIN AND E. CAYENNE ENGEL.** University of Tennessee—Effects of *Lespedeza cuneata* on species-level dynamics, community composition and structure, and ecosystem processes under global climate change.
- 9:15 232 **SINGHURST, JASON R.¹, EDWIN L. BRIDGES², AND STEVE L. ORZELL³.** Texas Parks and Wildlife Department¹, Botanical and Ecological Consultant², and Avon Park Air Force Range, Florida³—Regional and edaphic patterns of plant composition and diversity in herbaceous seepage slopes and bogs of the West Gulf Coastal Plain.
- 9:30 233 **ADAMS, CHRISTOPHER A. AND MELISSA B. DUDLEY.** Shorter College—Biomass allocation in *Ligustrum sinense* Lour. (Oleaceae) exposed to varying light regimes.
- 9:45 234 **BOLIN, JAY F.** Old Dominion University—Heat shock germination responses for three eastern temperate forest species.

- 10:00 235 **FRALISH, JAMES S. AND MIR L. FERDOUS.** Southern Illinois University—Linking forest response to measurable soil water, nutrient, and topographic characteristics: what samples, calculations, and parameters are important?
- 10:15 236 **JENKINS, MICHAEL A.¹, JOSE, SHIBU² AND PETER S. WHITE³.** National Park Service¹, University of Florida² and University of North Carolina-Chapel Hill³—Impacts of dogwood anthracnose and associated changes in community composition and structure on foliar calcium cycling in Great Smoky Mountains National Park.
- 10:30 237 **METHVEN, ANDREW, CHARLES PEDERSON, BRENT WACHHOLDER, AND VINCE HUSTAD.** Eastern Illinois University—Site and host specific variation in corticolous lichen assemblages in coastal floodplain forests.

FRIDAY, MARCH 30, 2006

AFTERNOON SESSION

**Bioinformatics Symposium/Workshop:
Community Standards and Research Questions
Tennessee Ballroom C
*Sponsored by the Society of Herbarium Curators***

Presiding: Zack Murrell, Appalachian State University

- 2:00 238 **MURRELL, ZACK E.** Appalachian State University—Community standards and SERNEC: Building a powerful research tool.
- 2:15 239 **MORITZ, TOM.** American Museum of Natural History—A Conservation Commons.
- 2:30 240 **RABELER, RICHARD K.¹ AND JAMES A. MACKLIN².** University of Michigan¹ and The Academy of Natural Sciences, Philadelphia²—Herbarium networks: advancing specimen data capture through cooperation.
- 2:45 241 **PEET, ROBERT K¹. JESSIE B. KENNEDY² AND NICO FRANZ³.** University of North Carolina at Chapel Hill¹, Napier University², and the National Center for Ecological Analysis and Synthesis³—Names are not sufficient: the challenge of documenting organism identity.
- 3:00 **COFFEE BREAK**
- 3:15 242 **WEAKLEY, ALAN S.** UNC Herbarium, North Carolina Botanical Garden, University of North Carolina at Chapel Hill—Analysis of change in the flora of the Carolinas from 1933 to 2006: concepts, names, ranks, and discoveries.
- 3:30 243 **HODGE, CHRIS.** University of Tennessee—Current Trends in Digital Library Development and the Implication for Botanical Collections.

- 3:45 244 **GINZBARG, STEVE.** University of Alabama—Customizing Darwin Core for plant data.
- 4:00 245 **LAPHAM, CHARLIE.** Kentucky Native Plant Society—Legacy data and the Darwin Core.
- 4:15 246 **AZPURUA-LINARES, FRANCIEL AND FRED RASCOE.** Southern Appalachian Information Node (SAIN) of the National Biological Information Infrastructure (NBII)—NBII & SERNEC: Information Management for the Future.
- 4:30 **WORKSHOP/DISCUSSION on Community Standards (4:30–5:45)**

Animal Ecology Tennessee Ballroom D

Presiding: Amy Turmelle, University of Tennessee

- 1:30 247 **TURMELLE, AMY S.¹, LOUISE C. ALLEN², CYNTHIA SCHMAEMAN³, MARY T. MENDONCA³, THOMAS H. KUNZ², AND GARY F. MCCRACKEN¹.** ¹University of Tennessee, ²Boston University, ³Auburn University—Ecological effects of innate and adaptive immune function in Brazilian free-tailed bats (*Tadarida brasiliensis*).
- 1:45 248 **TIBBELS¹, ANNIE E., ARNULFO MORENO², AND GARY F. MCCRACKEN¹.** The University of Tennessee¹ and Instituto Tecnológico de Cd. Victoria²—Local Scale Population Structure of the Common Vampire Bat (*Desmodus rotundus*).
- 2:00 249 **GREEN, J. JEFFREY AND MANUEL LEAL.** Vanderbilt University—Fight, flight, or just hide: a quantified study of crypsis in the timber rattlesnake (*Crotalus horridus*).
- 2:15 250 **HEINER, KRISTA AND MARK STANBACK.** Davidson College—Nest Site Competition Among Secondary Cavity Nesters: Are Bluebirds Bullies?
- 2:30 251 **SAUTERER, ROGER** Jacksonville State University, Jacksonville, AL—Incubation of frog embryos in waters and sediment extracts near the Monsanto plant (Anniston, AL) result in growth inhibition and abnormal behavior.
- 2:45 252 **ADAIR, BRIAN D. AND JAMES B. LAYZER.** Tennessee Technological University—Factors associated with the localized distribution of adult and juvenile freshwater mussels (Bivalvia: Unionoidea).

Herpetology Room 4/5

Presiding: John Placyk, University of Tennessee

- 1:30 253 **FELIX, ZACHARY¹, YONG WANG¹, AND CALLIE JO SCHWEITZER².** Alabama A&M University¹ and USDA Forest Service, Southern Research Station²—Movement patterns of eastern box turtles, *Terrapene carolina*, in forest stands managed for timber.

- 1:45 254 **BURTON, ELIZABETH C., MATTHEW J. GRAY AND A. CHANDLER SCHMUTZER.** University of Tennessee—Influences of cattle on Cumberland Plateau amphibians in a predator-rich environment.
- 2:00 255 **CHAN, FLORENCE, AND YONG WANG.** Alabama A&M University—Herpetofaunal community at the Walls of Jericho and Forever Wild properties in Northern Alabama.
- 2:15 256 **FISHER, ASHLEY R.¹, W. ROBERT GORDON² and THOMAS K. PAULEY¹.** Marshall University¹ and West Liberty State College²—The presence of *Chrysemys picta* intergrades in the eastern panhandle of West Virginia.
- 2:30 257 **GLORIOSO, B.M., ELIZABETH L. YOUNG AND VINCENT A. COBB.** Middle Tennessee State University—Population ecology of *Sternotherus odoratus* at Reelfoot Lake, Tennessee.
- 2:45 258 **BORDEN, JOEL A. AND DAVID H. NELSON.** University of South Alabama—A comparison of herpetofaunal communities between two upland mosaic habitats bordering the Mobile-Tensaw Delta.
- 3:00 259 **LOWERY, ADAM, DANIEL KLUCZNIK, AND JONATHAN AKIN.** Northwestern State University of Louisiana—Symbiosis between algae and *Ambystoma maculatum* salamanders.
- 3:15 **COFFEE BREAK**
- 3:30 260 **NIEMILLER, M.L., AND BRIAN T. MILLER.** Middle Tennessee State University—Phylogenetics of the Tennessee Cave Salamander (*Gyrinophilus palleucus*) complex.
- 3:45 261 **ROMINE, MICHAEL, TYLER POOLE AND JONATHAN AKIN.** Northwestern State University of Louisiana—Energetic costs associated with behavioral displays in the ground skink, *Scincella lateralis*.
- 4:00 262 **PLACYK, JOHN S., JR.,** Dept. of Ecology & Evolutionary Biology, University of Tennessee, Knoxville—Variation in life history traits and population demographics of insular and mainland populations of the common gartersnake (*Thamnophis sirtalis*).

Plant Ecology VI
Room 8/9

Presiding: Deborah McGrath, University of the South

- 1:30 263 **SLAPCINSKY¹, JODI L., DORIA R. GORDON¹ AND ERIC MENGES².** The Nature Conservancy, Gainesville, Florida¹ and Archbold Biological Station², Lake Placid, Florida—Responses of rare plant species to fire across Florida's fire-adapted communities.
- 1:45 264 **WALL, WADE A., THOMAS R. WENTWORTH AND WILLIAM A. HOFFMANN.** North Carolina State University—Vegetation and soils of a North Carolina Coastal Plain wet savanna.

- 2:00 265 **LU, ZHI-JUN^{1,2}, KE-PING MA¹.** Chinese Academy of Sciences¹, University of Memphis²—Croftonweed (*Eupatorium adenophorum*) Sweeping Southwest China along Roads and Streams.
- 2:15 266 **CARTER, ROBERT AND BRENT WOMACK.** Jacksonville State University—Landscape scale ecosystem classification in the Talladega Mountains of Alabama.
- 2:30 267 **FLEMING, MIRANDA M., JON M. STUCKY AND CAVELL BROWNIE.** North Carolina State University—Interactive effects and relative importance of neighboring vegetation and soil wetness on the growth and survival of *Solidago verna*, spring-flowering goldenrod, in the North Carolina Coastal Plain.
- 2:45 268 **MARIK, JULIE E. AND CLAUDIA L. JOLLS.** East Carolina University—Seed mass variation among and within populations of *Amaranthus pumilus*, seabeach amaranth, a federally threatened coastal annual.
- 3:00 **COFFEE BREAK**
- 3:15 269 **ROCK, JANET¹, DANIEL GAGNON² AND PATRICK NANTEL³.** Great Smoky Mountains National Park, Gatlinburg, TN¹, Groupe de recherche en écologie forestière interuniversitaire, Montréal, QC² and Parks Canada, Hull, QC³—Wild American ginseng populations in the southern Appalachians may be negatively affected by climate change.
- 3:30 270 **WALKER, GARY L.** Appalachian State University—Cliff-face ecology in the Southern Appalachians.
- 3:45 271 **BALLINGER, DAVID, GARY L. WALKER AND CHRISTIAN PETERSON.** Appalachian State University—A vegetational survey of an unclimbed cliff system at White Rocks, Cumberland Gap National Historic Park.
- 4:15 272 **STALTER, R.¹, ANNA JUNG¹, ANN STAROSTA¹, SAADIA SHALLALAH¹, JOHN BADEN², M.D. BYER³** ¹Department of Biological Sciences, St. John's University, Jamaica, New York, USA. ²U.S. Corps of Engineers, Wilmington, North Carolina, USA. ³Division of Natural Resources, Gateway National Recreation Area, National Park Service, Staten Island, New York, USA—Effect of wrack accumulation on salt marsh vegetation in South Carolina salt marsh.

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ASB POSTER SESSIONS
CC-Tennessee Ballroom A & B

Poster setup:	8:00 am – 9:00 am Thursday
Posters displayed:	8:30 am – 4:30 pm Thursday and 8:30 – 12:00 Friday
Presenters stand by posters:	1:30 pm – 2:30 pm Thursday (even numbers) 8:30 am – 9:30 am Friday (odd numbers)
Poster take-down:	12:00 pm to 1:30 pm Friday

Animal Biology and Ecology

- P1 **CHESH, ADRIAN¹, LUIS A. EBENSPERGER², AND LOREN HAYES¹.** University of Louisiana at Monroe¹ and Pontificia Universidad Católica de Chile²—Ecological correlates of degu (*Octodon degus*) sociality in central Chile
- P2 **FORONDA, JOSH AND TERRY RICHARDSON.** University of North Alabama—Foraging behavior of the Caribbean spiny lobster, *Panulirus argus*.
- P3 **HENNINGS, KATHLEEN, ADRIAN CHESH AND LOREN HAYES.** University of Louisiana at Monroe—Testing the intrauterine hypothesis in a wild population of house mice (*Mus musculus*).
- P4 **HEINER, KRISTA AND MARK STANBACK.** Davidson College—Nest Site Competition Among Secondary Cavity Nesters: Are Bluebirds Bullies?
- P5 **HUTCHENS, JOHN J., KEITH WALTERS, AZURE BEVINGTON AND LAUREN GREENFIELD.** Coastal Carolina University—Productivity of two common gastropods in a South Carolina salt marsh.
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- P8 **PRUE, CARIE¹, STACEY GARCIA², AND DENNIS C. HANEY¹.** Furman University¹ and Ursinus College²—The effects of urbanization on fish diversity and bioindicators of fish health in the Enoree River watershed, South Carolina.

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- P13 **DUDLEY, BREANNA, MICHAEL GOLOUBEV, RICHARD DENISE, AND MITSUE WIGGS.** Bowie State University—Concealed hypodermic syringe.
- P14 **HINLICKY, ANGELA AND D. JORGENSEN.** Roanoke College—Distribution of hydrostatic pressure in the branchial chamber of the American lobster, *Homarus americanus*.
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- P17 **AMMAY, KRISTEN¹, CLARYMAR ORTIZ², DENNIS C. HANEY¹, AND JOHN WHEELER¹.** Furman University¹ and Universidad Metropolitano²—Evaluating the presence of estrogen in wastewater treatment plant effluent in the Broad River watershed, South Carolina.
- P18 **BABELAY, ALLISON¹, GREGORY P. LEWIS¹, C. BRANNON ANDERSEN¹, ERESHA DESILVA², EDGAR E. LOPEZ³, CARLA MEJIAS³, VALERIE NIEVES³, AND FLOYD E. STANLEY¹.** Furman University¹, Texas A & M University², and Universidad Metropolitana³—Relationships between stream chemistry, suspended bacteria, and land cover in the Enoree River basin, South Carolina.
- P19 **DEES, WILLIAM H., AMY K. PHELPS, HARRY A. MEYER, CAROLINE E. CHAPMAN AND ALICE W. WARD.** McNeese State University—Snail and fire ant mound abundance in natural and restored marshes in southwest Louisiana.
- P20 **MEJIAS, CARLA¹, VALERIE NIEVES¹, ERESHA DESILVA², ALLISON BABELAY³, GREGORY P. LEWIS³, AND C. BRANNON ANDERSEN³.** Universidad Metropolitana¹, Texas A&M University², and Furman University³—Spatial variations of stream chemistry in three watersheds of varying urban land cover in northwestern South Carolina.
- P21 **PLUTCHAK, ROCHELLE^{1,2}, C. DREW FOSTER^{1,2}, ANDREA ANTON^{1,2}, KATE SHEEHAN^{2,3}, JUST CEBRIAN^{1,2} AND KELLY MAJOR³.** ¹University of South Alabama, Dept. of Marine Sciences, Mobile, AL. ²Dauphin Island Sea Lab, Dauphin Island, AL. ³University of South Alabama, Dept. of Biological Sciences, Mobile, AL—Microphytobenthic productivity associated with the placement of artificial oyster reefs in southern Alabama.
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- P23 **RASMUSSEN, JESSICA AND CHARLES L PEDERSON.** Eastern Illinois University—Classification of Illinois lakes and reservoirs and evaluation of the potential use of phytoplankton as biocriteria.

- P24 **SMITH, JOSH, WILLIAM ENSIGN AND JOSPEH DIRNBERGER.** Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Ecoregion effects on physical habitat and fish community structure.
- P25 **SQUIRES, ERIN, JOSPEH DIRNBERGER AND WILLIAM ENSIGN.** Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Ecoregion effects on stream aquatic invertebrate scraper communities.
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- P28 **COOKSON, NICHOLAS AND MARK S. SCHORR.** Dept. of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN 37403—Landscape influences on fish assemblages in a Ridge and Valley stream in Tennessee.
- P29 **DYER, SUSAN A.¹, MICHAEL H. PALLER², MARCEL J. M. REICHERT³, AND FRANK C. HELIES⁴.** ¹Westinghouse Savannah River Company, ²Savannah River National Laboratory, ³South Carolina Department of Natural Resources, ⁴Belle W. Baruch Institute for Marine Biology and Coastal Research—Utilization of disturbed and undisturbed bottomland floodplains by larval and juvenile fish.

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- P35 **BRYANT, DESIREE, AND DR. DEBORAH RAYFIELD.** Bowie State University, 14000 Jericho Park Road, Bowie, MD—The effect of Estrogen, Daidzen, and Genistein on PC-12 cell viability following hypoxic/ischemic exposure.

- P36 **CHANDLER, EMMANUEL L AND SANDRA F. LARSON.** Furman University—Effects of epidermal growth factor and follicle stimulating hormone on epidermal growth factor receptor expression in ovarian cancer cells.
- P37 **COBB, CRYSTAL¹, DIANA ACKAH¹, CAROLYN HOPPE M.D.², JAMES G. TAYLOR VI M.D.** ¹Vascular Medicine Branch, NHLBI, National Institutes of Health, Bethesda, MD 20892 ²Department of Pediatric Hematology/Oncology, Children's Hospital, Oakland, CA 94609—Establishing the incidence of putative genetic modifiers in DNA samples of newborns with Sickle Cell Disease from a state newborn screening program.
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- P55 **ABERCROMBIE, VICTOR¹, RICKY FIORILLO¹ AND BILL LUTTERSCHMIDT²**. Shorter College¹ and Sam Houston State University²—Habitat characteristics and movement of Copperhead, *Agkistrodon contortrix*.
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- P60 **FAILEY, ELISABETH L, JOHN C. MCCOY, STEVEN J. PRICE AND MICHAEL E. DORCAS**. Davidson College—Ecology of turtles inhabiting golf course and farm ponds in the Western Piedmont of North Carolina.

- P61 **FISHER, ASHLEY R.¹, W. ROBERT GORDON² AND THOMAS K. PAULEY¹.** Marshall University¹ and West Liberty State College²—Turtle assemblages in the eastern panhandle of West Virginia with an emphasis on the distribution of *Pseudemys rubriventris*.
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- P81 **PROUD, DANIEL N.¹, VICTOR R. TOWNSEND, JR¹, MICHAEL K. MOORE², AND PAUL M. RESSLAR¹.** Virginia Wesleyan College¹ and Mercer University²—A potential new species of harvestmen (Opiliones, Manaosbiidae) from Morne Bleu Ridge in the Northern Range of Trinidad, W. I.
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- P84 **TIBBETTS, JESSICA A., DANIEL N. PROUD, AND VICTOR R. TOWNSEND, JR.** Virginia Wesleyan College—Use of logs by arthropods in the rainforests of the Northern Range of Trinidad, W. I.

- P85 **TOWNSEND, VICTOR R. JR¹, AND MICHAEL K. MOORE².** Virginia Wesleyan College¹ and Mercer University²—The harvestmen (Arachnida, Opiliones) of Trinidad, W.I., with comments on new locality records.
- P86 **WOOLFOLK¹, SANDRA, RICHARD BAIRD¹, AND CLARENCE WATSON².** Department of Entomology and Plant Pathology, P.O. Box 9655¹, MAFES Administration, P.O. Box 9740², Mississippi State University, Mississippi State, MS 39762—Microflora associated with black imported/hybrid fire ants and their mounds in Mississippi.
- P87 **DEES, WILLIAM H.¹, GEORGE W. SCHULTZ², RICHARD G. ROBBINS² AND DAVID W. HILL².** McNeese State University¹ and Armed Forces Pest Management Board²—Ixodid tick morphology and identification: A laboratory teaching tool.

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- P97 **BARTER, KATHERINE, BS, MT¹ AND JAMES R. PALMIERI, Ph.D².** Virginia Polytechnic Institute Department of Biochemistry¹ and Center for Molecular Medicine and Infectious Diseases Virginia Maryland Regional College of Veterinary Medicine¹,and Department of Microbiology Division of Biomedical Sciences Virginia College of Osteopathic Medicine²—Gentamicin and the Symbiotic Relationship Between *Francisella* and *Acanthamoeba*: The Threat of an Epidemiological Crisis.
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- P121 **RITCHIE, JERRY C.¹, GREGORY W. MCCARTY¹, ERIK R. VENTERIS² AND LLOYD B. OWENS³.** USDA ARS Hydrology And Remote Sensing Laboratory¹, Ohio Division Of Geological Survey², and USDA ARS North Appalachian Experimental Watershed³—Effects of landscape management on soil redistribution and soil organic carbon content.
- P122 **ROBERTS, JOEY¹, COLLEEN IVERSEN² AND RICHARD NORBY³.** Middle Tennessee State University¹, University of Tennessee² and Oak Ridge National Laboratory³—Disentangling sweetgum and understory fine-root response at ORNL FACE: an isotopic approach.
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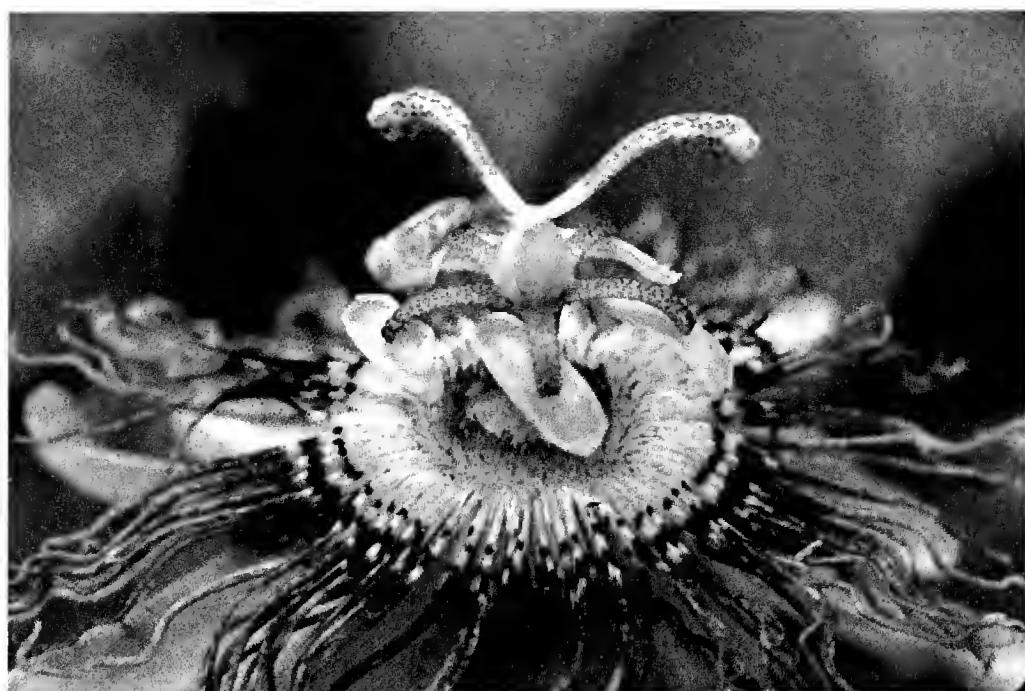
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Passiflora incarnata. Great Smoky Mountains National Park.

Photo by A. S. Heilman, University of Tennessee, Knoxville.

ABSTRACTS - PAPERS

- 1 SPENCER, JENNIFER A. College of Veterinary Medicine, Auburn University, AL—Vector-borne diseases: Ticks, bugs, and pathogens of importance to human and animal health.

A disease that is transmitted to humans or other animals by an insect or other arthropod is called a vector-borne disease. Insects are a major cause of human mortality and morbidity, largely as a result of infectious pathogens being transmitted by blood-feeding species. Transmission of these vector-borne diseases is governed by complex interactions between the parasites, the vectors and the hosts. Domestic and non-domestic animals often serve as a reservoir for these pathogens until susceptible human populations are exposed. Nearly half of the world's population is infected by vector-borne diseases that result in high morbidity and mortality. Rational control of these diseases requires an understanding of the links between various biological, environmental, agricultural and socio-economic factors.

- 2 GRIJALVA, MARIO J. Tropical Disease Institute, Biomedical Sciences Department, College of Osteopathic, Ohio University and Infectious Disease Research Laboratory, School of Biological Sciences, Catholic University of Ecuador—Chagas disease in Ecuador: Moving from research to control program implementation.

Chagas disease affects an estimated 300,000 people in Ecuador. An additional 3 million people are at risk of infection with *Trypanosoma cruzi*. Research efforts to document the status of disease in the country have been ongoing since 1992. The results have shown anti-*T. cruzi* seroprevalence, infestation with the triatomine insect intermediate host, and other biological and epidemiological aspects that characterize Chagas disease in the country. These results have prompted the country to go from a state of denial in the early 90s to the formation of a National Chagas Disease Control Program. The challenge for researchers now is on how to guide the national control efforts towards a long-term elimination of the disease.

- 3 BREITSCHWERDT, EDWARD B. College of Veterinary Medicine, North Carolina State University, Raleigh, NC—Concurrent infection with *Anaplasma*, *Bartonella* and *Ehrlichia* species.

Current research supports the hypothesis that the common evolutionary history of *Anaplasma*, *Bartonella* and *Ehrlichia* species has resulted in a modern day complex of pathophysiological interactions among these organisms. Following tick transmission, polymicrobial infections contribute to highly variable disease expression and increased severity of illness in both animals and human patients. Confirming infection caused by a single tick borne pathogen can be very challenging, particularly when evaluating chronic as compared to acute illness. The microbiological confirmation of polymicrobial tick borne infections, using current diagnostic modalities, can be much more difficult than confirming a solo infection. It has been recognized for some time that *A. phagocytophilum* can induce disease in cats, dogs, horses and human beings, and can also infect numerous other wild animal species that serve as reservoir hosts. *B. vinsonii (berkhoffii)*, initially isolated from a dog with endocarditis in our laboratory, was subsequently isolated from coyotes, foxes and a human with endocarditis in Europe. Infection with *B. henselae*, identified in the early 1990's as the predominant cause of cat scratch disease (CSD) and bacillary angiomatosis and peliosis hepatitis in immunocompromised individuals, is now known to be a much more prevalent infection in dogs than previously recognized. *E. canis*, *E. chaffeensis*, *E. ewingii* and seemingly *E. ruminantium* can infect both dogs and people. Importantly, organisms in

these genera are transmitted world wide to dogs and people by a diverse spectrum of tick species. Widespread variation in the number and types of tick borne pathogens found in different geographic locations further complicates the diagnosis of polymicrobial infections. For the future, researchers should continue to define the frequency and the medical implications of polymicrobial tick-transmitted infections in companion animals.

- 4 BLAGBURN, BYRON L. College of Veterinary Medicine, Auburn University, AL—
Lean, Mean, Transmission Machines: The Biology of Ixodid Ticks.

Ticks are second only to mosquitoes in their ability to transmit diseases. They are also important as primary disease agents and as such can cause irritation, anemia, hypersensitivity reactions, and toxicosis. The ixodid or hard ticks are important to human and animal health. They differ from argasid (soft ticks) in their structure, their unique physiologic mechanisms, and their life cycles, including the environmental locations of their developing stages. Important ixodid tick species include *Rhipicephalus sanguineus*, *Dermacentor variabilis* and *D. andersoni*, *Ixodes scapularis* and *I. pacificus*, and *Amblyomma americanum* and *A. maculatum*. Ixodid ticks are well adapted for transmission of disease agents. Factors that affect disease transmission are both intrinsic and extrinsic. Intrinsic factors include host-seeking behavior, host preference, seasonality of feeding and degree of tick/host contact, and duration of attachment. Extrinsic factors include host abundance, range, seasonality (climate), diurnal patterns, and susceptibility to agents. Ticks are known to harbor multiple pathogens. It is likely that competition between pathogens within the developmental environment in the tick also affects pathogen survival. Successful transmission of disease agents requires that ticks overcome attempts of the host to eliminate them (i.e. coagulation, platelet aggregation, pain/itch responses). They combat host responses by inhibiting calcium-binding proteins, immunoglobulins, interleukins, histamine, complement, and T-cell activity. Recent research has resulted in an increased understanding of tick transmitted protozoal diseases. Agents for which we now have improved understanding of their biology, improved diagnostic procedures, or effective treatments include babesiosis, cytauxzoonosis, and hepatozoonosis. We also now have effective tick control products for use on both humans and animals. Research has demonstrated that proper use of these products combined with vaccines (when available), knowledge of the behavior of ticks, and use of tick avoidance strategies can greatly reduce the likelihood of infection with tick-transmitted agents.

- 5 LANGDON, KEITH AND BECKY NICHOLS—Great Smokey Mountains National Park—History and Introduction of ATBI.

The All Taxa Biodiversity Inventory (ATBI), a project of Discover Life in America (DLIA), seeks to inventory the estimated 100,000 species of living organisms in Great Smoky Mountains National Park. The project will develop checklists, reports, maps, databases, and natural history profiles that describe the biology of this rich landscape to a wide audience. The species level of biological diversity is central to the ATBI, but the project is developed within an ecological and conservation context and encourages understanding at other levels of organization, including genetic variation within species and ecosystem descriptions. As of September 17th 2005, ATBI has identified 569 species new to science and 3,358 species previously not known to inhabit the Great Smoky Mountains National Park.

- 6 O'CONNELL, SEÁN P. Western Carolina University—Extensive bacterial diversity in soils and waters of Great Smoky Mountains National Park: How many species are out there?

Recent estimates have raised the estimate of bacterial diversity from 10^3 species **per gram** of undisturbed soil to 10^6 species. While this estimate is 'astronomically' large when one considers prokaryotes within Great Smoky Mountains National Park, it should not deter efforts to understand such diversity. Patterns of bacterial distributions should become clearer with repeated sampling. For the past four years, bacterial isolates have been obtained using R2A culture plates inoculated with samples from Kephart Prong and Oconaluftee River sites. The goal of this work is to determine whether the same species occur in attached and unattached life stages at each site and whether species would be common to both sites. Sequencing of ~550 bp of 16S rDNA and functional testing have been used to classify species. Results include the characterization of representatives from seven phyla, 39 genera, and 66 species. No overlap at the level of both sequences and functional traits (metabolic/physiological testing) has been seen. The proteobacteria dominated Kephart Prong soils while the High and Low G+C Gram Positive bacteria dominated Oconaluftee soils. Oconaluftee waters were dominated by the Cytophaga/Bacteroides/Flavobacteria and secondarily by the betaproteobacteria, the latter of which codominated at Kephart Prong aquatic sites, along with both gram positive groups. These disparities in diversity between samples from two similar sites indicate either microhabitat differences or small sample size. Long-term collection from these sites continues and a picture of the extent of diversity will hopefully emerge to allow predictive hypotheses to help explain the differences observed in these sites.

- 7 LICKY, EDGAR B.¹ SHANNON M. TIEKEN,² KAREN W. HUGHES¹ AND RONALD H. PETERSEN¹. University of Tennessee¹ and Rose-Hulman Institute of Technology² –Heterozygosity in *Artomyces pyxidatus* from the Great Smoky Mountains National Park.

Basidiomycete fungi from the Great Smoky Mountains National Park (GSMNP), often show heterozygosity for DNA insertion/deletion events in the nuclear ribosomal ITS region. We investigated this heterozygosity in *Artomyces pyxidatus* (= *Clavicorona pyxidata*). Within North America, two distinct haplotypes were observed; a southwestern US/Mexico/Costa Rica haplotype and a northeastern haplotype. These two haplotypes are thought to represent progeny from different refugia existing during the Wisconsin glacial period which ended 20,000 years ago. The haplotype distributions presently overlap forming a broad cline from southwest to northeast and hybrids between the two haplotypes have been found in nature. The GSMNP shelters both haplotypes. Three separate coves in the GSMNP were intensively sampled. Haplotype frequencies were examined to determine if cove forests sheltered reproductively isolated populations of *A. pyxidatus* and if the two haplotypes were in Hardy-Weinberg equilibrium. There were no significant differences between GSMNP populations with respect to gene frequencies; however, the two haplotypes are not in Hardy-Weinberg equilibrium in the GSMNP because, in this species, there is a heterozygote deficiency. Such a deficiency can occur if individuals are largely self-fertilizing or if there are genetic or environmental barriers to interbreeding. Since both haplotypes were sometimes found on the same log, it appears unlikely that inbreeding by isolation is responsible.

- 8 KELLER, HAROLD W. Central Missouri State University–Tree Canopy Biota in the Great Smoky Mountains National Park.

The first survey and inventory of tree canopy biota is part of the All Taxa Biodiversity Inventory in Great Smoky Mountains National Park. Student climbers used the double rope climbing technique to obtain tree canopy bark samples of ferns, lichens, liverworts, mosses, macrofungi, and myxomycetes up to 40 meters. A fern, *Polypodium appalachianum*, was discovered growing as a canopy epiphyte 40 m above ground level on the upper surface of a horizontal branch on a champion-sized *Liriodendron tulipifera* tree. A soil-forming mat of humus supported four species of mosses typically associated

with ground habitats, but were absent from bark samples taken at various heights from the vertical tree trunk. Tree canopy bark samples analyzed have yielded 37 moss species and 28 liverworts species, all previously known from ground sites. Approximately 84 lichen species from the tree canopy represented new records for the Park but were also known from ground sites. Five basidiomycete species (macrofungi) were collected from the tree canopy; none were new records. Ninety-five myxomycete species were recorded from the tree canopy, including 52 new records for the Park. *Diachea arboricola* was restricted to the upper canopy of living trees and represented the only myxomycete species new to science discovered in the Park. Myxomycetes represent the only group collected that have species only known from the tree canopy. Financially supported by National Science Foundation, Biodiversity Surveys and Inventories, Awards DEB-0079058 and 0343447, Discover Life in America 2001-26 and 2002-17, and National Geographic Committee for Research and Exploration 7272-02.

- 9 LOWE, REX L.¹ AND JEFFREY R. JOHANSEN². Bowling Green State University¹ and John Carroll University²—Diatom species (Bacillariophyceae) from subaerial habitats in the Great Smoky Mountains National Park.

Diatoms and other algae have been collected and identified from subaerial habitats in the Great Smoky Mountains National Park as part of a larger biodiversity survey of the park. Algal collections were made across a range of moisture gradients and bedrock mineralogies with pH ranging from 4 to greater than 7. None of the communities collected were totally submerged in water, but were often associated with moist mosses and cyanobacterial mats. Some of the collections are from cliff faces wetted only periodically. To date, 52 diatom genera and over 160 species have been identified from these habitats. Several of these genera are widely distributed across aquatic habitats. However, several of the genera are “subaerial specialists” and possess morphological features such as reduced size, reduced external openings in the cell wall, or additional external siliceous membranes that allow them to survive in relatively dry habitats. Widely distributed species with high fidelity to subaerial habitats occur in the genera *Decussata*, *Diadesmis*, *Fragilariaformosa*, *Luticola*, *Melosira*, *Nupella* and *Orthosira*. Many of the species constitute new park records, national records, or are new to science.

- 10 JOHANSEN, JEFFREY R. AND REX L. LOWE. John Carroll University and Bowling Green State University—New algal records from Great Smoky Mountains National Park.

Since 1999 we have been involved in the effort to collect and identify all algal species in the Great Smoky Mountains National Park. This effort has been a part of a larger such effort for all phyla in the park known as the All Taxa Biodiversity Inventory (ATBI). As of 2004, we had reported 584 taxa of algae, including 108 Cyanobacteria, 97 Chlorophyta, 12 Tribophyta, 1 Chrysophyta, 2 Synurophyta, 3 Eustigmatophyta, 353 Bacillariophyta, 4 Dinophyta, 3 Rhodophyta, and 1 Eglenophyta. We have added over 200 new records to this list, including a number of new species. New records have been especially rich in Cyanobacteria (62), Chlorophyta (74), and diatoms (57). Distinctive habitats in the park include wet rock walls, seeps, and waterfall splash zones (subaerophytic epilithic communities) as well as tightly crustose communities on the rocks in streams. Particularly unusual findings include *Heribaudiella fluviatilis* (Phaeophyta), *Rhodospora sordida* (Rhodophyta), *Arnoldiella* and *Drapernaldia* (new species, Chorophyta), and a number of new diatom species.

- 11 COX, PATRICIA B.¹. AND RICHARD SCHULZ.² TVA Heritage Program¹ and GSMNP²—Pteridophyte distribution in the Great Smoky Mountains National Park.

With the help of funding through the Hesler Grant from the University of Tennessee, the fern project began in the summer of 1999. There were four goals for the original study: 1. To locate and validate herbarium voucher specimens for all the species reported from the GSMNP, 2. to revisit known fern localities to verify the plant's occurrence in the GSMNP, 3. to search for new populations of species occurring in the park and also look for new additions to the pteridophyte flora of the GSMNP, and 4. to produce a data base of current information on the pteridophytes of the GSMNP for the ATBI (All Taxa Biodiversity Inventory) project. These goals or a portion of each have been reached. In addition the original goals, we also began mapping the distribution of ferns in the park. To date, approximately 200 miles of 57 trails have been surveyed. We are using the trails as transects. Every 200 meters, we make a 15 m circular plot and record all the fern species present as well as population density for each species. We are also recording associated tree species found in each plot. Between the plots, we are making qualitative reports on the ferns present along the trail. These data have been input into an ACCESS program and maps will be generated using GIS tools to relate these distributional data to various GIS layers such as vegetation, slope, and aspect. Once "all" the trails have been surveyed we hope to get a better understanding of the biogeography of fern species in the park.

- 12 WETZEL, MARK J.¹ AND PEGGY MORGAN². Illinois Natural History Survey Centerfor Biodiversity, Champaign¹ and Florida Department of Environmental Protection, Tampa²—Aquatic Oligochaeta (Annelida) in the Great Smoky Mountains National Park, North Carolina and Tennessee, USA.

The class Oligochaeta represents the most diverse and widely distributed group of annelids in freshwater habitats in North America. Oligochaetes are commonly an important and often dominant component of the benthic community, yet specimens rarely are identified beyond class or family level because of perceived difficulty in taxonomic resolution. To date, 209 species of freshwater oligochaetes representing 12 families and 75 genera occur in North America based upon published distributional records; over half of these species occur in the southeastern U.S. While numerous publications over the last 25 years have focused on the aquatic oligochaete fauna in North America, none has focused on oligochaetes occurring in the Great Smoky Mountains National Park (GSMNP). Funding received from Discover Life in America through the All Taxa Biodiversity Inventory program has supported our surveys for aquatic oligochaetes, other macroinvertebrates, and water quality at 136 streams, springs, seeps, lentic habitats, and cave pools in the GSMNP. To date, 24 species of aquatic oligochaetes representing 10 genera in the families Enchytraeidae, Haplotaxidae, Lumbriculidae, Tubificidae (including the subfamily Naidinae) have been identified from our collections; all represent new Park records, and four are reported as new state records (NC, TN). As expected, the abundance of oligochaetes collected in the moderate to high gradient streams was low. However, the low diversity at most of the sites we have surveyed is surprising, given the pristine water quality and variety of aquatic habitats present in the GSMNP, and the diversity of freshwater oligochaetes previously reported from the southeastern U.S.

- 13 BERNARD, ERNEST C. The University of Tennessee, Knoxville—Biodiversity explosion: Collembola of Great Smoky Mountains National Park (GRSM).

Collembola are the most abundant insects, sometimes numbering 50,000/m² in temperate deciduous forest. Previous to the ATBI, 55 species had been reported from GRSM, some of which were misidentifications. Currently, more than 200 species are recognized in GRSM, including more than 60 species new to science and more than 100 new records. In addition, reexamination of type specimens in collections dating to the 1940s has validated a number of species that had been synonymized with other taxa, such as in the genus *Morulina*. One new genus has been collected and three new species belonging to previously non-North American genera have been found (two South American, one

Mediterranean). Several new records are major range extensions, for instance, *Folsomia nivalis* known previously from the Canadian Maritime provinces and *Hypogastrura tooliki* described from Alaska. Digital imaging and videography of live springtails is being used to more accurately render appearance and coloration, and to document behaviors and interactions with other soil and litter biota. Molecular differentiation of *Tomocerus* spp. is underway, in order to more reliably separates the many similar species of this common genus. A Lucid-based online key for identification of southern Appalachian Collembola is under construction; where possible, this key will use characters visible with a dissecting microscope to separate species.

- 14 OLIVER S. FLINT, JR.¹, LUKE M. JACOBUS², W. PATRICK McCAFFERTY², BORIS C. KONDRATIEFF³, JOHN C. MORSE⁴ AND CHARLES R. PARKER⁵. National Museum of Natural History, Smithsonian Institution¹, Purdue University², Colorado State University³, Clemson University⁴, U. S. Geological Survey⁵—The aquatic insect fauna of Great Smoky Mountains National Park

The Great Smoky Mountains National Park contains more than 3,400 km (> 2,000 miles) of streams, numerous springs and seeps, as well as temporary ponds, bogs, and other specialized habitats. In addition, much of the south side of the park borders Lake Fontana, a large Tennessee Valley Association reservoir. The rugged topography of the park creates considerable habitat complexity. Combined with the moist, mild climate of the southern Appalachian region, a rich fauna of aquatic insects occurs within the Smokies. At this time, nearly 450 species of the orders Ephemeroptera (104 species), Plecoptera (116), Megaloptera (6), and Trichoptera (223) are known from the park.

- 15 CARLTON, CHRIS AND VICTORIA BAYLESS. Louisiana State University Arthropod Museum—Documenting beetle diversity in the Smokies; past the half-way point!

The current Coleoptera Taxonomic Working Group of the All Taxa Biodiversity Inventory (ATBI) has been active since June 2001. It consists of a core group of students and researchers who are headquartered at the Louisiana State Arthropod Museum, and is supported by a network of 28 specialists worldwide. Our starting point was ~700 species based mainly on specimens collected prior to 2001 and deposited in the Great Smoky Mountains National Park (GSMNP) collection. Using our in-house Biota® relational database and periodic species accumulation analyses we have documented more than 1100 new species records for the park among the 10,352 specimen records to date, including 20 species new to science. Thus our current beetle species count for GSMNP is 1803 species from 97 families. We project total beetle diversity for the park will be ~3000 species based on extrapolation of figures for the 20 largest families in eastern North America. Most additional records are expected to derive from taxonomic work on the following families: Staphylinidae, Curculionidae, Tenebrionidae, Scarabaeidae, Latridiidae, and Ptilliidae. Progress has been hampered by a lack of taxonomic expertise and logistical problems associated with large specimen volumes. The former problem is society wide and the latter has been partially solved. The vast majority of specimens processed to date were derived from structured protocols conducted during the initial phase of the ATBI. Current and future efforts will be focused on samples collected during organized Beetle Bioblitzes and/or using specialized techniques targeting taxa that cannot be accessed using mass collecting methods.

- 16 YOUNG, JOY AND GEORGE W. BENZ. Middle Tennessee State University—Rapid colonization of neonate lemon sharks by monogeneans.

Sharks are commonly infected by monogeneans (Monogenea); however, few data exist regarding how soon after birth neonates become infected. Fifty-one lemon sharks,

Negaprion brevirostris, captured about Bimini, Bahamas were examined for the presence or absence of monogeneans. Thirty-one percent of the sharks were infected by *Dermophthirius nigrellii*. Twenty-five of these sharks were neonates less than 8-10 weeks old and some of these were as young as 3-4 weeks old. Twenty-four percent of the neonates were infected by *D. nigrellii*, with the youngest sharks estimated to be 3-4 weeks old. These results indicate that lemon sharks can be infected by *D. nigrellii* soon after birth. This phenomenon may have important husbandry implications when neonate sharks are selectively acquired for aquarium operations with the assumption that they will not yet be infected by monogeneans. This study was partially supported by an Undergraduate Research, Scholarship and Creative Activity Scholar award to J. Young from Middle Tennessee State University.

- 17 MCELWAIN, ANDREW AND GEORGE W. BENZ. Middle Tennessee State University—Reconsidering phylogeny within Sphyriidae (Siphonostomatoida, Copepoda).

Sphyriidae (Siphonostomatoida, Copepoda) contains 9 genera and 16 species whose transformed adult females are highly modified mesoparasites of fishes. The only published phylogeny for these copepods appeared well supported by morphological data, implied a pattern of coevolution between these parasites and their hosts, and has been widely accepted. Reconsideration of that analysis prompted us to reject those results in favor of more conservative and ambiguous set of results that do not support any definitive conclusions regarding sphyriid (Sphyriidae) coevolution or historical ecology. Based on our analysis we conclude that because the highly transformed habitus of sphyriids befuddles some considerations of homology and results in a paucity of morphological data that can support a phylogenetic analysis, we must await the results of molecular studies to provide a robust phylogeny for these parasites.

- 18 COOK, JOSHUA O¹, ROBIN M. OVERSTREET¹ AND R. RAMA KRISHNA². The University of Southern Mississippi, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS¹ and ANGR Agricultural University, Andhra Pradesh, India²—Pathology associated with fatal myxozoan infections in farmed carp, *Catla catla*, from India.

Farmed catla carp (*Catla catla*) fingerlings from a mass mortality in aquaculture ponds in Veerammagunta, India, exhibited heavy infections of *Myxobolus* sp. in the gill filaments. Macroscopic cysts surround the cartilaginous rods of multiple filaments and in some cases even extend around the gill rakers. Chronic inflammation involved the infected gill filaments with hyperplasia and fusion of the lamellae. Host capillaries persist within involved filaments, allowing for the transport of blood within the cyst. Myxozoan spores were not found among any host tissues except the gills. The heavy infection of *Myxobolus* sp. can adversely affect host gill filaments, reducing host's ability to respire. Some bacteria, perhaps occurring post-mortem, infiltrated the body musculature, but the myxozoan infection was the apparent cause of mortality of this commercially valuable fish.

- 19 BAKER, TIFFANY G.¹ AND ISAURE DE BURON². Grice Marine Laboratory¹ and Biology Department², College of Charleston, SC—Stock identification of the Atlantic croaker, *Micropogonias undulatus* Linnaeus, using macroparasites as biological tags

The Atlantic croaker, *Micropogonias undulatus*, is a commercially and recreationally important fish present from the Chesapeake Bay to the Gulf of Mexico. Though croaker in the Gulf of Mexico are known to be genetically distinct from those in the Atlantic Ocean, it is uncertain whether those within the Atlantic Ocean comprise one or multiple unit stocks. In this study macroparasites were used as biological tags to identify stocks present along the Atlantic coast of the United States. Croaker specimens were collected from fall 2002 –

spring 2005 via trawling efforts ranging from New Jersey to Florida. Results concerning the chosen tags and croaker stock structure based on those tags will be presented. Funded by a MARFIN grant NA17FF2885.

- 20 LUCAS, A¹., W. S. SWECKER¹, G. SCAGLIA², D. S. LINDSAY¹, F. C. ELVINGER¹, J. P. FONTENOT², AND A. M. ZAJAC¹. VA/MD Regional College of Veterinary Medicine¹ and Dept. of Animal and Poultry Sciences², Virginia Tech—Population dynamics of *Eimeria* spp in grazing beef calves in Virginia.

Species of the coccidian genus *Eimeria* infect cattle worldwide causing economically significant production losses and clinical disease in some animals. The objective of this study is to characterize coccidia populations in naturally infected beef calves in Virginia. Rectal fecal samples were collected from 68 calves monthly for 5 consecutive months beginning in May, 2005. Calves were 26-76 d of age at the start of the study and grazed with their dams in groups of 6 cow/calf pairs with a stocking density of 0.67- 0.73 hectares/animal unit. No incidence of clinical coccidiosis was seen during the study. Numbers of *Eimeria* spp oocysts were determined by the modified McMaster's test and coccidia species were identified by examination of oocysts recovered with the Wisconsin sugar flotation test. Oocyst counts were log transformed and geometric means were determined. The mean oocyst count in May was 140 oocysts per gram (OPG) and oocysts were detected in 85% of samples. The percentage of positive samples increased in subsequent months, reaching 100% in September. Monthly geometric mean oocyst counts from June to September were 377, 905, 621 and 848 OPG. *Eimeria bovis* was the most common species seen every month (present in 84% to 100% of positive samples between May and September). Other common species (present in more than 50% of the samples from at least 3 collections) were *E. zuernii*, *E. alabamensis*, *E. auburnensis*, *E. pelita*, *E. canadensis* *E. illinoiensis* and *E. cylindrica/ellipsoidalis*. Less common species (*E. bukidonensis*, *E. subspherica*, *E. brasiliensis* and *E. wyomingensis*) were present in 50% or fewer samples from at least 3 collections. All 12 *Eimeria* spp were seen every month with the exception of *E. wyomingensis* in May and *E. bukidonensis* in July. Results indicate that grazing Virginia beef calves are infected by the second month of life with a diverse population of *Eimeria* spp.

- 21 GOODWIN, DAVID G., SOLANGE M. GENNARI², DANIEL K. HOWE³, J.P. DUBEY⁴, ANNE M. ZAJAC¹, AND DAVID S. LINDSAY¹. Virginia Tech¹, Universidade de São Paulo², University of Kentucky³, USDA Animal Parasitic Diseases Laboratory⁴—Prevalence of antibodies to *Encephalitozoon cuniculi* in Brazilian horses.

Encephalitozoon cuniculi is a zoonotic intracellular parasite found in rabbits and other domestic animals. It is regarded as an emerging human pathogen. Little is known about this parasite in horses. Recently 72 horses from 3 Israeli farms were tested, 60% (43 horses) were seropositive for *E. cuniculi* by indirect fluorescent antibody assay (IFA). *Encephalitozoon cuniculi* was implicated as causing abortion in a Quarter horse mare from Kentucky. Stages were detected using transmission electron microscopy and PCR detected *E. cuniculi* in the placenta. *Encephalitozoon cuniculi* was also detected in the kidney and brain of a stillborn Clydesdale foal from South Africa using light microscopy and Gram staining (*E. cuniculi* spores are Gram positive). We have recently developed a direct agglutination test to detect IgG antibodies to *E. cuniculi* in serum. The serum from 554 Brazilian horses was tested for the prevalence of *E. cuniculi* antibodies using the agglutination test. A majority of the samples were from older horses (>10 years) that were culled and sent to a slaughterhouse. Sixty-nine (12%) of the horses were positive for antibodies to *E. cuniculi* at a 1:50 dilution. Positive samples are currently being examined for IgG antibodies using IFA and Western blot tests. Supported in part by a Clinical

Research grant from the Virginia-Maryland Regional College of Veterinary Medicine to DSL.

- 22 LASCANO, MAURICIO S.^{1,3}, ANITA VILLACIS², AND MARIO J. GRIJALVA³. Department of Biological Sciences, Ohio University, Athens, OH¹. School of Biological Sciences, Catholic University, Quito, Ecuador². Tropical Disease Institute, Biomedical Sciences Department, College of Osteopathic Medicine, Ohio University, Athens, OH³—Molecular characterization of *Trypanosoma rangeli* isolates from Ecuador.

Entomological surveys in Manabi and Loja provinces of Ecuador revealed high incidence of Triatominae insects (Hemiptera: Reduviidae) vectors of Chagas disease. This disease affects approximately 16 million people in South America. The epidemiology of Chagas disease has been hampered by *Trypanosoma rangeli*, very similar to *T. cruzi* in terms of morphology, life cycle, and biochemical features. Both parasites share the same mammal reservoirs and insect vectors. The serological diagnostic methods that are currently available for Chagas disease usually fail to discriminate efficiently between infections caused by *T. cruzi* or *T. rangeli*, causing false-positive results for Chagas. This study attempts to elucidate the origin of the strains of *T. rangeli* found in Ecuador, and to understand the interactions of this parasite with *T. cruzi* and its vectors. *Rhodnius ecuadoriensis*, *Triatoma carrioni*, *Panstrongylus chinai*, *P. rufotuberculatus*, and *Erasmus mucronatus* were collected on 23 rural communities of Loja. *R. ecuadoriensis* and *P. howardi* were collected in five communities of Manabi. Salivary glands, haemolymph, intestinal contents, and feces were obtained from the insects. PCR tests were run on those samples. PCR amplification products were excised from the gels, cloned, and the nucleotide sequences are being determined by automated sequencing. The isolation of *T. rangeli* strains and the study of their molecular characteristics are essential achievements since this is the first report of *T. rangeli* in Ecuador. Moreover, the final results of this study will provide important insights about the influence of *T. rangeli* in the epidemiology and seroprevalence of Chagas disease in the country. Support for this study was provided by the Vice President for Research of Ohio University through the Student Enhancement Award Program.

- 23 PINTO, C. MIGUEL^{1,2}, SOFÍA OCAÑA¹, MAURICIO LASCANO³, AND MARIO J. GRIJALVA³. Laboratorio de Investigación en Enfermedades Infecciosas, Escuela de Ciencias Biológicas, Pontificia Universidad Católica del Ecuador, Quito, Ecuador¹; Present address: Department of Biological Sciences, Texas Tech University, Lubbock, TX, USA²; Tropical Disease Institute, College of Osteopathic Medicine, Department of Biomedical Sciences, Ohio University, Athens OH, USA³—Infection by trypanosomes in marsupials and rodents associated to human dwellings in Ecuador.

The genus *Trypanosoma* comprises species that parasitize mammals, including humans; among them, *T. cruzi* causes Chagas disease affecting more than 18 million people in the Americas. This report shows the results of surveys of mammal reservoir hosts of trypanosomes in the provinces of Manabí, Loja and Guayas. We conducted trapping sessions focused in nonvolant mammals in and around human residences (< 50m from the houses). We collected all the trapped animals and obtained blood samples to perform trypanosome searches using direct microscopy and hemoculture. Animals were considered positive if flagellates were observed by any of the two tests performed. Parasite identifications were performed by morphological characteristics and by polymerase chain reaction. We captured 222 animals belonging to 9 species, 2 marsupials and 7 rodents. Twenty two animals (9.9%) were positive for trypanosomes. Fifteen (6.8%) were infected with *T. cruzi* (4 of 36 *Didelphis marsupialis*; 1 of 8 *Philander opossum*; 1 of 85 *Mus domesticus*; 9 of 64 *Rattus rattus*). Eleven *R. rattus* (17.2%)

harbored *T. lewisi*, five of them presented mixed infections with *T. cruzi*. Additionally, 1 of 3 *Oryzomys xantheolus* were infected with *T. rangeli*. None of the individuals of *Proechimys decumanus* (n = 11), *Akodon orophilus* (n = 4), *Sigmodon peruanus* (n = 3), and *R. norvegicus* (n = 8) showed trypanosomes. Most of the isolates belong to *T. cruzi* suggesting that *R. rattus* are important reservoir hosts of Chagas disease due to the high numbers of infected animals and their close relationship with human dwellings.

- 24 WIMSETT, ASHLEY, AMY ANDERSON, AND CHRIS HALL. Department of Biology, Berry College, Mount Berry Ga.—Humoral recognition of *Trypanosoma cruzi* antigens in raccoons from the Berry College campus.

Trypanosoma cruzi is a protozoan parasite endemic to the Southeastern United States. Sera from raccoons trapped on the Berry College campus were used to assess parasite prevalence and the nature of the humoral responses to *T. cruzi* infection in this important reservoir host species. Twenty three raccoons were trapped and sero-conversion tested by ELISA. Of those sera tested 74% tested positive for *T. cruzi* exposure. Western blot analysis was performed by using the positive sera to identify the nature of recognition. Antigen preparations were run on PAGE gels under denaturing conditions and transferred onto nitrocellulose membranes. Membranes were divided into strips with each incubated with a different positive raccoon sera. Membranes were developed with DAB and the molecular weights of positive bands determined by comparison with molecular weight ladders. We found that all sero-positive raccoons recognized an antigen of approximately 47-50 kD. Some sero-positive animals also recognized an additional antigen at approximately 75 kD. The difference in recognition profiles appears correlated to the titer of parasite specific antibody. Further characterization of these antigens and their ability to induce protection in experimentally infected mice continues to be a priority.

- 25 PIERCE, EMILY, BRAD MEERS, AND CHRIS HALL. Department of Biology, Berry College, Mount Berry Ga.—Vertical Transmission of North American Type II and a South American Type I isolates of *Trypanosoma cruzi* in BALB/c mice.

Vertical transmission of *Trypanosoma cruzi* is well documented. What is less certain is whether all strains exhibit similar transmission patterns. This is especially of interest in North American versus South American strains of the parasite since in North America *T. cruzi* has evolved with placental mammals as the principal sylvatic reservoir hosts, while in South America marsupial species have dominated. Female BALB/c mice were infected with either the Brazil strain (BS), a Type I South American isolate, or the Lemur Isolate (LI), a Type II strain of *T. cruzi* from North America. Breeding pairs were established and monitored for reproductive success. Pups generated from these breedings were weighed and sacrificed at two weeks after birth. Tissues were harvested from pups for PCR analysis using the TCZ primer set. BALB/c mice infected with the BS of *T. cruzi* failed to generate any off-spring. Those infected with the LI produced off-spring in comparable numbers to those of uninfected control females. Of those pups born to LI infected female mice, approximately 50-60% were found to be infected. This data suggests that the LI has a greater propensity toward vertical transmission than the BS. This is consistent with the co-evolution of this strain in placental mammals and possibly represents an increased reliance on this mechanism for transmission.

- 26 VINCENT, AMANDA G. AND JEFFREY M. LOTZ. Gulf Coast Research Laboratory, The University of Southern Mississippi—Evolution of virulence: transmission from dead hosts.

Evolution of virulence suggests a pathogen may evolve toward lesser virulence to ensure host survival and consequently pathogen survival. A measure of pathogen lifetime reproductive success is the basic reproduction number R_0 which is the average number of

new infections produced by a single infection. R_0 is maximized when virulence is 0 thus evolving lesser virulence would seem the best evolutionary strategy. However, other pathogen life history traits may be dependent upon virulence resulting in constraints and tradeoffs. In particular an inverse dependence of transmission on virulence can maximize R_0 at virulence $\neq 0$ resulting in a balance between transmission and virulence at an optimal level. Models of evolution of virulence typically assume that host death ends infectivity. But what about systems where pathogens are transmitted from dead hosts? We present data obtained through experimental infections for two pathogens Necrotizing hepatopancreatitis-bacterium (NHPB) and Taura syndrome virus (TSV) affecting penaeid shrimp aquaculture where transmission occurs primarily through cannibalism of dead infected hosts. In these systems, transmission is unrelated to the host being alive. After host death, virulence is not a component of R_0 but it does affect the probability of transmission from dead hosts. Virulent strains may not only kill hosts more rapidly than less virulent but they may also reach a higher lethal load thus having a greater probability of transmission after host death. When dead hosts are the source of pathogen transmission R_0 is not maximized instead R_0 increases as virulence increases.

- 27 HARRIS, SHAWNA AND CLAIRE A. FULLER Murray State University—Immunity in dragonfly naiads (Odonata: Anisoptera): indicators of water quality.

It is important that scientists have an early-warning system capable of identifying environmentally stressed organisms before the stressors cause irreparable population or regional harm. Terrestrial insects with aquatic stages are good biological indicators of both short and long-term environmental change because their life cycles expose them to multiple stressors in both aquatic and terrestrial environments. Currently, however, there are no studies examining immunity as an indicator of environmental health in insects. We collected larvae of the dragonfly *Libellula lydia* in seventeen ponds in western Kentucky. Hemolymph was collected from the larvae and assayed for prophenoloxidase, phenoloxidase, and protein content of hemolymph. Individuals were measured for head width and body length. Water and sediment was analyzed from each pond for metals, organophosphates, PCB's, temperature, and pH. Increased levels of prophenoloxidase, phenoloxidase, protein content of hemolymph, and increased body size have been linked to an increased ability to resist infection in insects. Our hypothesis is that as water quality decreases, immune parameters will decrease. This study was funded by a research grant from USGS.

- 28 SAVAGE, MASON Y. AND MICHAEL J. YABSLEY. Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia—Sequence polymorphisms in the mismatch-repair (TcMSH2) and glutathione-S-transferase (Tc52) genes of *Trypanosoma cruzi* isolates from United States wildlife.

Trypanosoma cruzi, causative agent of American trypanosomiasis or Chagas disease, can cause fatal myocarditis in many species including humans and dogs. Molecular characterization of *T. cruzi* isolates from the United States is limited. Recently a multi-locus sequencing typing approach has been used to characterize *T. cruzi* isolates from South America. Two of these genes, the mismatch-repair (TcMSH2) and glutathione-S-transferase (Tc52) have shown multiple nucleotide and amino acid substitutions between *T. cruzi* I and *T. cruzi* II, the two major genetic groups of *T. cruzi*. In this study, we amplified and sequenced the variable regions of these two genes from 15 raccoon and 5 opossum isolates of *T. cruzi* from Georgia and Florida. Based on studies conducted in South American reservoirs, we hypothesized that raccoons and opossums will be infected with genetically distinct *T. cruzi* and because of the wide geographic separation we hypothesize that these US isolates of *T. cruzi* will differ from those from S. America. In this study, sequences of the TcMSH2 and Tc52 genes from *T. cruzi* from opossums and

raccoons were separated into two main groups corresponding to *T. cruzi* I and *T. cruzi* II, respectively. Only limited nucleotide and amino acid substitutions were noted between the US and South American samples. Future work will include obtaining sequence data from additional isolates from host species over a wide geographic range in order to 1) better understand the genetic variability within this highly diverse species and 2) test for any *T. cruzi* genotype and host species associations.

- 29 SELLERS, P¹, L. LOCKHART², AND L. SIMPSON³, AND ANDREW KEEWATIN⁴. University of North Carolina at Pembroke¹, Winnipeg, Canada², Peterborough, Canada³ and Grassy Narrows, Canada⁴—Mercury in the sediment and crayfish of lakes in the territories of Anishinabek people: 25 years after the big mercury spill.

Gross mercury pollution of the English-Wabigoon River system (northwestern Ontario, Canada) took place between the late 1960s and early 1970s. This was a consequence of effluent discharge into the Wabigoon River by a chlor-alkali plant/pulp mill. The mercury levels in fish and people have been studied since pollution and sickness was identified. The affected First Nations, who still live with the consequences of mercury pollution, undertook their own study in 2004. This included a survey of the mercury levels in sediment and crayfish of several lakes, which was last done in the late early 1980s by government officials. The results of the recent survey will be shown in this presentation. The data were not as expected for Ball Lake, which strongly suggest no decline in sediment or crayfish mercury levels. Also, sediment profiles in Ball Lake did not show the expected pattern of mercury burial, which has already been established for upstream Clay Lake. Knowledge of sediment and mercury accumulation rates (²¹⁰Pb dating methods) is helping to elucidate the patterns of mercury dynamics in these lakes. Relatively recent and aggressive logging in the watersheds by forest product companies needs also to be considered when viewing these data.

- 30 PITCHFORD, JONATHAN, TONY GRECO, AND MICHAEL WINDLESPECT. Appalachian State University—Influence of metal pollution and concurrent biofilm production on benthic macroinvertebrates in a disturbed high elevation wetland.

Anthropogenic disturbances such as urban development and surface mining alter groundwater supply and/or natural stream flow introducing pollutants that significantly impact high elevation wetlands. A disturbed stream fed wetland in Watauga County, NC has been monitored for the past two years to further understand such impacts. Differences in macroinvertebrate community composition are apparent when comparing disturbed portions of the stream to areas upstream of the disturbance. Differences are likely accounted for by changes in water chemistry and microbial community composition downstream. Levels of zinc and iron in stream and manganese levels in the soil are significantly higher than levels measured at a pristine reference wetland. The presence of a biofilm forming bacterial community is also present at the downstream site. The biofilm contains a sheath forming bacterium believed to grow in response to increased levels of reduced iron and manganese ions. A preliminary study examining the effects of biofilm on *Elimia* indicate a relationship between biofilm levels and mortality. Identification of the biofilm forming bacterium using molecular genetic techniques (PCR, FISH) is an initial step in understanding macroinvertebrate community response to disturbance. Other experiments and analysis techniques currently underway include examination of sensitive species preference for clean or contaminated substrata, measurements of bacterial growth on insect body surfaces, body burden analysis measuring metal bioaccumulation in insect tissues, LC₅₀ analysis to determine metal toxicity of sensitive species, and microbial community analysis. These methods should help to further clarify the effects of terrestrial disturbance on water quality as indicated by community structure.

- 31 FINCEL, MARK J., CHARLES L. PEDERSON AND ROBERT U. FISHER. Eastern Illinois University—Flow variability and the effects of municipal sanitary discharge on downstream fish and invertebrate communities.

For the past 7 years we have conducted an intensive sampling program in effort to document temporal and spatial heterogeneity of an 8.5 km reach of the Sangamon River beginning just below Lake Decatur Dam and extending downstream to incorporate discharges from the Sanitary District of Decatur (SDD). Our objective has been to characterize stream habitat quality and to assess impacts resulting from ongoing discharge from a municipal waste treatment plant and from flow variability due to current reservoir management practices. Based on the Stream Habitat Assessment Procedure (SHAP), this reach of the Sangamon River is a fair quality aquatic ecosystem, with minimal habitat heterogeneity. Thirteen sample locations were chosen and sampled for fish and macroinvertebrates during the summers of 1998 and 2001-2005. The Index of Biotic Integrity (IBI) and Macroinvertebrate Biotic Index (MBI) were used as biocriteria to further assess quality of this stream reach. While fish IBI scores fail to discern differences between the reaches upstream and downstream of the SDD discharge, the MBI characterizes the downstream reach as a better quality habitat. Macroinvertebrate diversity increases with distance from the reservoir although fish diversity remains constant. However, multidimensional scaling based on Bray-Curtis Index of Similarity reveals that both macroinvertebrate and fish assemblages change downstream of the SDD discharge. We speculate that outflow from the SDD may ameliorate low flows resulting from the minimal reservoir discharges that are frequent during most of the year.

- 32 NOE, GREGORY¹, JUDSON HARVEY¹, AND JAMES SAIERS². U.S. Geological Survey¹ and Yale University²—Suspended particles in Everglades wetlands: characterization and importance to phosphorus transport.

The surface-water transport of phosphorus (P) is an important process relevant to the basic functioning and restoration of the Everglades and other wetlands. Although considerable research has focused on the ecological effects of P enrichment on the Everglades, very little is known about how surface-water P moves through the wetland. Improved understanding of the processes that control P transport is critical for predicting the effects of the proposed increases in water inputs to the Everglades on the spread of anthropogenic P to less impacted, downstream areas. Therefore, we quantified spatial and temporal patterns in suspended particle concentrations, size distributions, nutrient content, and P fractionation. Particulate P concentrations were greatest in P-enriched areas, and these particles were likely labile based on particulate N:P content and P fractionation. Particles (0.2 to 100 µm) contained 23-85% of total water column P at sites across the Everglades. The size distribution of suspended particles was relatively stable across sites and time, with 54-85% of all particulate P occurring in the 0.45 to 2.7 µm size class. The size distribution, P fractionation, and Ca content of particles suggest that most of particles containing P in the water column are microbes, and findings from our tracer experiments demonstrate that the surface-water transport of microbe-sized particles differs substantially from that of dissolved solutes. In conclusion, suspended particles hold a large proportion of P in the water column, are likely dominated by microbes, contain labile P, and have different transport properties than solutes, and thus must be considered in models of P transport in the Everglades.

- 33 ZOELLNER, DANIELLE C., JAMES LUKEN AND KEITH WALTERS. Coastal Carolina University—Response of *Juncus roemerianus* to Restoration of Saltwater Influence in Sandpiper Pond, Huntington Beach State Park, South Carolina

Managing human impacts and restoring ecological processes in the coastal zone has become a leading concern for land managers working in coastal preserves. Sandpiper

Pond, located at Huntington Beach State Park in Murrell's Inlet, SC, was historically a tidally influenced saltwater pond dominated by *Spartina patens* and *Juncus roemerianus*. Following Hurricane Hugo a large-scale dune building project was undertaken along the SC coast in order to safeguard coastal development and ameliorate ecological devastation due to hurricanes. This activity along with previous road construction essentially closed Sandpiper Pond to tidal influence and it has subsequently become a freshwater system dominated by *Typha angustifolia* and the invasive *Phragmites australis*. While dramatic changes in vegetation are evident bird and fish communities have also been impacted. Managers at Huntington Beach State Park, in conjunction with several partners, are attempting to restore tidal connections and saltwater influence to this system. We have taken this opportunity to examine the response of transplanted *Juncus roemerianus* plugs in Sandpiper Pond, the impacted site, and the Jetty Pond Control Site. In addition, we are investigating the relationship between this restoration effort and plant community composition, plant biomass, soil pore water salinity and soil carbon content. It is our hope that long term monitoring of Sandpiper Pond will provide practical information for managers and professionals tasked with restoration of other tidally influenced aquatic systems in the coastal zone.

- 34 EZELL, P. TAYLOR, BENJAMIN M. COALE, JONATHAN M. MILLER, AND NEIL BILLINGTON. Troy University—Comparison of Trophic State Index (TSI) for Southeast Alabama ponds.

A lake trophic state index (TSI) can be used as an indicator of the productivity of a water body. In 1997, Carlson developed a TSI based on Secchi disk depth. Carlson also included in his research equations that transformed chlorophyll, total phosphorus and total nitrogen levels into the TSI. Little work involving TSI has been conducted in the southeastern United States. Many ponds in southeastern Alabama have nutrients added by the owner, especially phosphorus, to enhance fish productivity. This fertilization should expand the range of TSI values observed. We surveyed 40 water bodies in southeastern Alabama, including 36 man-made ponds, 2 beaver ponds, and two reservoirs. On-site measurements were taken for Secchi disk, total dissolved solids, turbidity, total alkalinity, hardness, and pH. In addition, vertical profiles of temperature, dissolved oxygen and conductivity were recorded. Depth-time diagrams were drawn for five ponds over a one-year time frame. Sub-surface water samples were collected from each site and nutrient (total phosphorus, orthophosphate, total nitrogen, nitrate and nitrite) and chlorophyll concentrations were determined. These values were used to equate a TSI and were compared with the TSI values obtained from the Secchi disk depth data from Carlson's index. Our study suggest the water bodies surveyed in Southeastern Alabama range from oligotrophic to highly eutrophic when using Carlson's TSI.

- 35 PILARCZYK, MEGAN M.¹ AND PAUL M. STEWART². Wake Forest University¹ and Troy University²—Contemporary and recent historical freshwater mussel assemblages in the Gulf Coastal Plains of Alabama and Florida.

The freshwater mussel population in the southeastern United States is very diverse yet highly imperiled. Regular evaluation of the status of this group of organisms is essential for their protection. In 2004, we conducted a qualitative survey of the freshwater mussel assemblages at 25 sites in southeastern Alabama and northwest Florida. Our efforts were particularly focused on the status of seven candidate species: *Margaritifera marrianae*, *Fusconaia escambia*, *Lampsilis australis*, *Pleurobema strodeanum*, *Ptychobranchus jonesi*, *Quincuncina burkei*, and *Villosa choctawensis*. The 2004 survey information was compared to recent historical records from the 1990s using presence-absence analysis. While there was no significant difference between the number of taxa found in the 1990s and in 2004, there was a significant decline from the 1990s to 2004 in the number of candidate species found at a site and the number of sites at which candidate species were

found. All of the candidate species except *P. jonesi* declined over the time span examined. *Pleurobema strodeanum* declined at the most number of sites from the 1990s to 2004, making it a species of utmost concern. Because the historical data often lacked abundance and number of man hours, it was difficult to make direct comparisons between recent historical data and our 2004 data. We recommend that future mussel surveys follow protocols such as those prepared by Carlson (et al.) and report the following from each site: number of species, number of individuals of each species (live and dead), and number of man hours.

- 36 GEORGE, ROBERT Y. AND JULIA KIRKLAND BERGER. George Institute for Biodiversity and Sustainability—Concept of “Biobank” and Species Inventory: Priorities in the Southeastern United States.

Our lack of understanding of biodiversity in land and aquatic ecosystems in the southeastern United States at the species level presents fundamental problems. This deficit in knowledge presents a challenge with the ongoing shift from single species to ecosystem based management. Recent focus in the last decade on “All Species Encyclopedia” revealed the magnitude of the task to inventory 8 million undescribed species on a global scale, let alone the 1.8 million of known species. The lack of taxonomic expertise and poor funding for museum facility improvement continues to impede the progress of systematic biology. This paper recommends a regional approach in the southeastern United States using North Carolina as a model. This model emphasizes tropho-dynamics, focusing on the lower taxonomic spectra of the pyramid. GIBS envisages the Biobank initiative as a priority since it includes plant and animal species in the following three crucial habitats one; coastal marine, one estuarine, and one freshwater) (A) Deep-water Coral Ecosystem off Cape Lookout, NC, (B) Cape Fear River Delta Ecosystem (Southport, NC), and (C) Freshwater Ecosystem in Great Smoky Mountains National Park with diversity of clams, crayfish, and salamanders. In view of the potential threat to loss of critical habitat status in the Endangered Species Act (ESA) phase one of the Biobank initiative will focus on (1) plant and animal endangered and threatened species and (2) habitat-forming species in deep-water coral ecosystem. Biobank project will verify population status of endangered species and identify potential new endangered species in these chosen ecosystems.

- 37 OGASAWARA, MASAMICHI. Clemson University—A comparison of spatial variability associated with ephemeral wetland ponds in the Duke Forest, North Carolina.

Isolated, ephemeral wetlands are common in many deciduous forest areas, but the flora that surrounds them has received little study. One of the most notable features of ephemeral ponds is the distribution of herbs in zones around their perimeters related to micro-elevation and hydroperiod. I evaluated variations in herb-layer species composition in relation to changes in soil and micro-elevation surrounding three ephemeral ponds in the Duke Forest, Durham, North Carolina. Compositional variation among sample plots was evaluated using Non-linear Multidimensional Scaling (NMS) ordination. Herb-layer composition varied considerably among the three sample ponds and was correlated with elevation in each case. Correlations were strongest between 2nd or 3rd axis scores and elevation, indicating zonation among a subset of herb-layer species. Species richness, on the other hand, was either not related to elevation or decreased with increasing wetness. In general, soil pH showed no relationship to elevation or distance to pond center, and it was not correlated with variations in species composition.

- 38 DIRNBERGER, JOSEPH, WILLIAM ENSIGN, STEVEN RANNEY, JOSH SMITH, ERIN SQUIRES AND RYAN STONER. Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Physical and biological signals in streams along an ecoregion boundary.

The ecoregion concept has been widely used by resource management agencies monitoring changes in environmental conditions. While its utility is well-established in terrestrial systems, its applicability to aquatic systems is less obvious. In this study, we compared physical and biological parameters from six separate stream sites in a watershed straddling the Piedmont and Ridge and Valley ecoregions in west-central Georgia. Measures of water chemistry, stream morphology, periphyton community structure and productivity, invertebrate community structure, fish condition and fish community structure were obtained from each site in an attempt to discern patterns correlated with the relative proportion of the watershed area contained within the two ecoregions. Water conductivity showed a strong positive correlation with the proportion of watershed area above each site contained in the Ridge and Valley ecoregion, as did the ratio of chlorophyll a to chlorophyll c. There were no discernible trends associated with ecoregion area for any of the other measures obtained. Our data suggest that while ecoregion may have an effect on periphyton composition, the signal is not propagated through the higher trophic levels in the biological community. Qualitative observations on human impacts in the study watersheds suggest these results are tentative at best, as anthropogenic influences may have obscured the signal in both the physical and biological components of these systems.

- 39 VANDANA, CHATURVEDI , RAJA KUMARAGURU, LAKSHMI PULAKAT, NARA GAVINI. Mississippi State University—Amino Terminus of NifM acts as a regulatory region for the Peptidyl prolyl cis/ trans isomerases activity of NifM.

The Parvulins are ubiquitous and a highly conserved family of Peptidyl prolyl cis/ trans isomerases (PPIases). The ESS1 in *Saccharomyces cerevisiae* was the first parvulin to be found in eukaryotes. Mutations in the ESS1 protein rendered the yeast strains temperature sensitive. The ESS1 temperature sensitive strains (ESS1^{TS}) grew like the wild type at lower temperature but were unable to grow at restrictive temperatures. Studies have shown that human Pin1, an ESS1 homologue, was able to rescue the ESS1^{TS} strains. NifM from *Azotobacter vinelandii* protein is 292 amino acid long and helps in regulation of the Fe protein. A homology search showed that the carboxy terminus of NifM shows a high homology with the PPIase domain from the eukaryotes. Structural analysis showed that the common motifs and putative catalytic residues were conserved. It would then be interesting to see if the NifM from *Azotobacter vinelandii* could rescue the ESS1^{TS} strains. The 876-basepair-*nif m* was cloned into pYES2.1 TOPO vector downstream of galactose promoter and then transformed into ESS1^{TS} strain H164R. Interestingly while the full-length Nif M was unable to rescue the ESS1^{TS} mutants, the truncated NifM containing only the C terminal PPIase domain could do so. Protein interaction studies using bacteriostat two-hybrid system have shown that the amino terminus of NifM interacts with its carboxy terminus. Our complementation studies have shown that when *nifH*, the substrate for *nifm*, is present along with entire *nifm*, the ESS1^{TS} mutants could grow at restrictive temperature. This elucidates that the substrate *nifH* is binding at amino terminus of the NifM and thereby opening and exposing the carboxy terminus catalytic domain for the isomerisation activity. The complementation data along with protein interaction studies supports our hypothesis that the amino terminus of NifM is conformationally blocking the catalytic activity of its carboxy terminus.

- 40 JOHNSON, MARY AND DWAYNE WISE. Mississippi State University—Characteristics of Kinetochore movement in cells undergoing mitosis without replication.

Chinese hamster cells (CHO) can be arrested with hydroxyurea at the beginning of the DNA synthesis phase of the cell cycle. Subsequent treatment with the xanthine, caffeine, induces cells to bypass the S-phase check point and enter unscheduled mitosis. Cells so treated build a normal spindle and distribute kinetochores, unattached to chromosomes, to the daughter cells. Immunocytochemistry is then used to study the proteins that are involved in their unusual mitosis. Our results imply that the usual proteins are involved in spindle and kinetochore function in these cells.

- 41 CHAMBERS, MELISSA G. AND DWAYNE WISE. Mississippi State University – Is a spindle matrix a common feature of mitosis?

In dividing *Drosophila* cells, a spindle matrix is composed of at least four distinct proteins. In other cell types, the presence and function of this matrix is controversial. We have used antibodies to the matrix proteins to examine their role cell division in other organisms. We have found two of these proteins in cricket meiocytes, where they have a distribution similar to that of *Drosophila*. Here we report our findings using other insect cells and cultured mammalian cells. These results support the hypothesis that some variety of spindle matrix is a conserved feature of both mitosis and meiosis.

- 42 RAVINDRA, KOLHE, NARA GAVINI AND LAKSHMI PULAKAT. Mississippi State University, Mississippi State–Insulin receptor-angiotensin II receptor AT1 association results in development of insulin resistance.

Patients suffering from hypertension often develop non-Insulin dependent diabetes mellitus (NIDDM), a condition caused by Insulin resistance. Though these patients have normal Insulin receptor (IR) and high levels of Insulin in blood, they fail to have IR-mediated signaling essential for glucose uptake and availability. NIDDM usually begins as insulin resistance, a condition in which Insulin Receptor (IR)-mediated signaling that leads to glucose uptake and glucose availability to cells is inhibited even in the presence of high levels of Insulin in blood. Mechanisms for the development of this Insulin resistance in patients suffering from hypertension are unclear. Angiotensin II (Ang II) and its receptor AT1 are implicated in hypertension. We show that the AT1 associates with IR and intracellular kinase Jak2 in response to Ang II binding and induces tyrosine phosphorylation of IR in the absence of Insulin in human cell line MCF-7. This AT1-induced phospho-protein pattern of IR and its associating proteins differs from the Insulin-induced phospho-protein pattern of IR and its associating proteins, implying that AT1 can modify IR and alter its signaling. Ang II also inhibits ¹²⁵I-Insulin binding to IR at concentrations similar to those seen in patients suffering from hypertension. Therefore, Insulin-independent, Ang II-induced tyrosine phosphorylation of IR prevents IR from binding Insulin and contributes to Insulin resistance. The observation that drugs that inhibit Angiotensin II converting enzyme (ACE), or activation of AT1 receptor, not only reduce hypertension, but also induce insulin sensitivity further supports the role for Ang II and AT1 in the development of NIDDM.

- 43 LIU, PENGDA AND JOHN W. STILLER. East Carolina University–Mutational analysis of the essential functional sequence in the yeast RNA polymerase II C-terminal domain.

The carboxyl-terminal domain (CTD) of the largest subunit of RNA polymerase II plays a number of essential roles in RNAP II transcription. The CTD is known to bind many protein factors that link transcription to pre-mRNA capping, splicing and polyadenylation. It comprises a unique set of tandemly repeated heptapeptides, with the consensus sequence Tyr₁ Ser₂ Pro₃ Thr₄ Ser₅ Pro₆ Ser₇, and is conserved through evolution from yeast to mammals. Previous work in our lab showed that mutational insertions of alanine

residues between adjacent repeats are lethal while mutants with alanines between diheptads are viable. This indicates that the essential functional unit of the yeast CTD is contained within pairs of heptapeptides. We have further zeroed in the essential sequence within the diheptad unit from both ends. Two substitution mutations (ASPTSPSYSPS and YSPTSPSYSPTAA) were analyzed. The former is lethal while the latter supports viability, indicating that at least a Y to Y motif is essential. We further investigate two additional sets of mutations (YAAPTSPSYSPS and YAPTAPTYSPS) to thoroughly define the essential sequence within the diheptad unit. Once the essential unit is determined, we will compare direct interactions of viably and lethally mutated CTDs, with CTD partner proteins, to better understand the mechanisms of CTD function.

- 44 AGHORAM, KARTHIK¹, MATTHEW R. KEOGH², JEFFREY W. GILLIKIN,
MICHAEL GOSHE², ERIK J. SODERBLOM² AND RALPH E. DEWEY². Meredith
College and North Carolina State University—Phospholipid signaling pathway in
plants – the role of a hyperosmosis-activated protein kinase.

Cellular signaling in response to water deficit is highly complex and involves an array of signaling molecules. Inositol-based compounds like PIP₂ and IP₃ accumulate or turn over in response to osmotic stress and are believed to mediate cellular stress-signaling processes. However, little is known about the early signaling events that transduce osmotic-stress perception into changes in polyphosphoinositide metabolism. We have discovered in plants two early components of a novel signaling pathway, which we hypothesize regulates polyphosphoinositide metabolism during hyperosmotic stress. First, we identified Ssh1p, a membrane-associated phosphatidyl inositol transfer protein. Second, we identified the protein kinase (SPK1) that phosphorylates Ssh1p. This Ser-Thr kinase belongs to the SnRK2b family, members of which are now emerging as key components of osmotic-stress responses in plants. Hyperosmotic stress mediates the activation of SPK1 leading to Ssh1p phosphorylation *in vivo*. This pathway is conserved in all plants tested, and can be reconstituted in yeast. Our current efforts are focused on elucidating the mechanism of activation of the SPK1-Ssh1p pathway, and understanding its role in regulating whole-plant response to osmotic stress and phospholipid metabolism. We have purified active and inactive forms of recombinant SPK1 from yeast to assess structural differences that may explain the mechanism of its activation. Recent results indicated that recombinant SPK1 is activated by phosphorylation in yeast. We have used tandem mass spectrometry to pinpoint the sites of regulatory phosphorylation. Our results are discussed here.

- 45 DIEHL, WALTER J. Mississippi State University—Gene function and phylogeny
affect patterns of natural selection in the Mycoplasmatales.

Understanding genetic mechanisms of divergence is facilitated by identifying associations between natural selection and gene function in a phylogeny. Preliminary results indicate that in the Mycoplasmatales, cellular process genes show greater adaptive fixation and purifying selection than metabolism genes at one phylogenetic node. As genomes of more species are sequenced, relationships between natural selection, gene function, and phylogeny can be evaluated more robustly to test null hypotheses of neutrality among functional groups of genes and among multiple phylogenetic nodes. Nucleotide sequences of ten Mycoplasmatales species with completed genomes (June 2005) were identified from NCBI COG functional categories, translated into amino acid sequences, and amino acids aligned (Clustal X). Nucleotides were re-aligned from amino acid alignments (DAMBE). A phylogeny was reconstructed from 16S RNA sequences (maximum parsimony, outgroup *Lactobacillus acidophilus*; DAMBE). Natural selection was detected by dN/dS ratios (MEGA) and neutrality indices (DnaSP) at five nodes in the phylogeny. Significance was set conservatively ($\alpha=0.00001$) to correct for Type I errors. Intracellular trafficking and secretion (ITS) genes showed greater significant adaptive

fixation (Neutrality Index<1) and purifying selection (dN/dS<1) at deep Mycoplasmatales nodes than either post-translational modification/protein turnover/chaperone genes or carbohydrate transport & metabolism genes. Patterns of selection on ITS genes varied among nodes, indicating that genetic mechanisms of divergence at a given node may be unique. ITS genes occupied more discrete locations in adaptive space, indicating that they may show a greater interaction between function and selection that affects divergence than genes of other functional groups. Supported by NSF EPSCoR 0082979.

- 46 BHATTARAI, SMRITI AND ALICIA WHATLEY. Troy University—Induction of cytochrome P450 in channel catfish (*Ictalurus punctatus*) following exposure to Troy (Alabama) waste water treatment plant effluent.

Induction of the cytochrome P450 enzyme in fish, measured as ethoxresorufin-O-deethylase (EROD) activity, has been extensively used as a biomarker in assessing the effects of contaminants on aquatic ecosystems. This study focuses on whether exposure to Troy (Alabama) waste water treatment plant (WWTP) effluent induces transcription of mRNA for cytochrome P4501A1 enzyme production and increases EROD activity in channel catfish (*Ictalurus punctatus*). Transcription of mRNA, EROD activity and allometric indices were measured for samples collected. In most cases, reverse transcriptase-polymerase chain reaction (RT-PCR) confirmed the presence, absorption and distribution of compounds that are capable of inducing transcription of CYP1A1 mRNA in the liver of catfish. A three-fold induction of EROD activity in catfish exposed to WWTP effluent compared to Walnut Creek upstream was found significant, using a Wilcoxon Signed Ranks test (p= 0.038). Big Creek (Barbour County, AL) was used as a reference site for administration of a positive control chemical (PCB – Aroclor 1254). However, there was no significant increase in enzyme levels by PCB treatment over the untreated control. Determining the induction of cytochrome P450 and subsequent enzymatic activity in catfish and other fish species common to this region can be a potent way to monitor pollution effects at the molecular level.

- 47 STILLER, JOHN W. AND LESLIE HARRELL. East Carolina University—The kingdom Plantae hypothesis: functional constraint and short-branch exclusion in deep molecular phylogeny.

Evolutionary analyses of the largest subunit of RNA polymerase II (RPB1) have yielded the consistent inference of independent origins of red algae and green plants, at odds with the widely accepted view of a monophyletic Plantae comprising all eukaryotes with “primary” plastids. If the Plantae hypothesis is correct, then RPB1 trees likely reflect a persistent phylogenetic artifact. To gain a better understanding of RNAP II evolution, and this presumed artifact relating to plants and red algae, we analyzed RPB1 from representatives of Glauccystophyta, the third eukaryotic group with primary plastids. Phylogenetic analyses incorporating glauccystophytes do not recover a monophyletic Plantae; rather they result in additional conflicts with the most widely held views on eukaryotic relationships. In particular, glauccystophytes are recovered as sister to several amoebozoans with strong support. A detailed investigation shows that this clade can be explained by what we call “short-branch exclusion,” a phylogenetic artifact integrally associated with “long-branch attraction.” Other systematic discrepancies observed in RPB1 trees can be explained as phylogenetic artifacts; however, these apparent artifacts also appear in regions of the tree that support widely held views of eukaryotic evolution. In fact, most of the RPB1 tree is consistent with artifacts of rate variation among sequences and co-variation due to functional constraints related to C-terminal domain based RNAP II transcription. Our results reveal how subtle and easily overlooked biases can dominate the overall results of molecular phylogenetic analyses of ancient eukaryotic relationships.

- 48 RITTER, STEFANIE AND VICTORIA TURGEON. Furman University—The Effects of Trypsin Inhibitor on Axon Direction, Elongation, and Motoneuron Survival

During development, synapse formation is dependent upon successful axon extension and elongation towards the target cell. With particular regards to the skeletal neuromuscular system, axons extend from spinal motor neurons (MNs) towards muscle cell targets. The balance of serine proteases and their inhibitors, the serpins, is thought to play a role in this axon extension and elongation. One such serine protease, trypsin, has been found in the developing neuromuscular system of vertebrate embryos. To examine the role of trypsin in axon formation and MN survival, embryonic chick cultures were grown in the presence and absence of trypsin inhibitor. A co-culture system of lumbar MNs and hind limb skeletal muscles cells was developed and used to determine the effects of trypsin inhibitor on axon length, direction towards target muscle cell, and MN survival. Trypsin inhibitor did not significantly affect axon length, direction of axonal growth, and MN survival in the developing chick two days after culture. However, trends in data suggest that trypsin might still play a signaling role in axonal direction. Future studies need to assess effects of higher concentrations of trypsin inhibitor on co-cultures of MNs and hind limb muscle cells.

- 49 BOBOWSKI, CHRISTIE AND ELI V. HESTERMANN. Furman University—Combinatorial gene regulation by the estrogen and aryl hydrocarbon receptors.

The estrogen receptor (ER) is a ligand-activated transcription factor that promotes transcription in two ways. ER either directly binds to DNA at estrogen responsive elements (EREs) on gene promoters, or it stabilizes another transcription factor that in turn promotes transcription. Ligands of another ligand-activated transcription factor, the aryl hydrocarbon receptor (AhR), are known to have both estrogenic and anti-estrogenic effects in cells and animals. In order to explore these dual effects of AhR ligands, we exposed MCF-7 cells to estradiol (E2, an ER ligand) and/or TCDD (an AhR ligand) and measured the relative amounts of mRNA for four ER-regulated genes by real time RT-PCR. The genes cathepsin D (CATD) and EBAG9 are both directly regulated by the ER whereas c-myc and cyclin D1 (CCND1) are indirectly regulated by ER. As expected, there were high levels of expression of all genes in cells exposed to E2; however, there was also induction of gene expression in cells exposed to TCDD. This result supports recent findings that the ligand-occupied AhR can affect the ER in the absence of its ligands to cause transcription. In the presence of ER ligands, AhR ligands have been shown to inhibit the estrogenic response. We found this pattern in levels of EBAG9 and CATD; however, when cells were exposed to both TCDD and E2 the levels of c-myc and CCND1 were not significantly lowered versus E2 alone. This pattern of gene regulation suggests that AhR only inhibits ER function when ER interacts directly with DNA regulatory sequences.

- 50 TALLEY, JENNELL M., JENNIFER L. OSTERHAGE AND KATHERINE L. FRIEDMAN. Vanderbilt University—Regulation of Est1p by degradation in G1 phase of the cell cycle.

Telomerase is a ribonucleoprotein complex that replicates the ends of chromosomes, or telomeres, in most eukaryotes. The telomerase complex is made up of three proteins (Est1p, Est2p, and Est3p) and an intrinsic RNA template, *TLC1* RNA. In *S. cerevisiae*, telomerase is activated in late S phase of the cell cycle and remains competent to extend telomeres into G2/M. Chromatin immunoprecipitation studies indicate that the catalytic core of the telomerase complex, including Est2p and *TLC1* RNA, is constitutively bound to telomeric chromatin, but Est1p association with the telomere occurs in late S phase and decreases upon entry into G1, suggesting that Est1p may be a critical regulator of

telomerase activity. Here, we show that Est1p levels are decreased in G1-arrested cells when compared to G2-arrested cells. This decrease in Est1p expression cannot be attributed to transcriptional regulation, since steady state levels of *EST1* mRNA are only slightly reduced in G1. Indeed, *EST1* mRNA is more stable in G1 than in G2/M. Upon analysis of the half-life of Est1p we find Est1p is degraded more rapidly in G1, when compared to G2/M. This degradation is proteosome-dependent, because treatment with MG132, a general proteosome inhibitor, increases the half-life of Est1p in G1 arrested cells. Indeed, treatment of G1 arrested cells with MG132 allows Est1p to accumulate and is sufficient to facilitate the association of Est1p with the catalytic core of telomerase. These results suggest that assembly of the telomerase complex is in part regulated by proteosome-mediated degradation of Est1p.

- 51 MCHUGH, ROBERT, SMRITI BHATTARAI, CHRISTI MAGRATH, PHILLIP REYNOLDS, AND ALICIA WHATLEY. Troy University—A putative cytochrome p450 mRNA induced by exposure to waste water treatment effluent in channel catfish.

An investigation of the effect of waste water treatment on activation and expression of cytochrome p450 in the channel catfish indicated that induction occurs within 3 days of exposure to effluent and reaches a peak induction level at 6 days after which levels slowly drop to basal levels. Activation was assessed using enzymatic assessment of EROD activity and RT-PCR of liver from exposed channel catfish. The amplification of total RNA by RT-PCR used oligonucleotide primers designed from an alignment of known p450 sequences from a variety of fish species, and RT-PCR produced specific products of the expected size. However, because of the presence of non-specific products, the purification of the putative p450 DNA segment (band) and subsequent sequencing will enable confirmation of the product's identity as cytochrome p450.

- 52 KECK, BENJAMIN P. AND THOMAS J. NEAR. University of Tennessee—Hybridization in *Nothonotus* darters (Percidae).

Hybridization has the potential to be an important factor in speciation and lineage diversification. Many recent studies of hybridization have focused on hybrid zones and the mechanisms of reproductive isolation. Hybrids are known to occur in *Nothonotus* darters, a monophyletic group of 20 described species, of which 17 species are sympatric with at least one other *Nothonotus* species. Most species in *Nothonotus* exhibit no parental care, but a monophyletic group of 5 species exhibits parental care through male nest guarding. We wanted to determine if male guarding had an effect on the frequency of hybridization among *Nothonotus* species. We searched museum specimens for putative F₁ hybrids between *Nothonotus* species and found over 90 specimens. Of these, 72% involve *Nothonotus rufilineatum* as a parental species, 64% involve *N. chlorobranchium*, 45% involve *N. camurum*, and only 17% involve species that exhibit male nest guarding parental care. We also used mitochondrial and nuclear DNA sequence data to determine if there is a pattern of introgression among *Nothonotus* species. We discuss both sets of results in relation to the potential mechanisms of reproductive isolation, as well as the difficulties that may arise when attempting to interpret *Nothonotus* phylogeny from sets of conflicting gene trees.

- 53 BOSTROM, BETHANY S.¹, ROBERT U. FISCHER¹, CHARLES L. PEDERSON¹, SCOTT J. MEINERS¹ AND DAN E. SHOUP². Eastern Illinois University¹ and Oklahoma State University²—Artificial Riffles as a Remediation Technique in Three Illinois Streams.

Over the past century, channelization of Illinois streams has been a major factor in loss of stream habitat heterogeneity. The Illinois Department of Natural Resources installed 30

artificial riffles on 8 different creeks between 2000 and 2003 in effort to increase habitat heterogeneity and restore streams to their original state. Species richness, diversity, Index of Biotic Integrity (IBI), and similarity of fish assemblages in artificial and natural riffles were compared in three east-central Illinois streams ($N > 2000$). Ashemore Creek, Hurricane Creek, and Sugar Creek were selected because they span stream orders from 1 to 3. IBI scores categorized all sites as good quality but scores did not differ between artificial and natural riffles or streams. Species richness did not vary by stream order for natural riffles, but artificial riffles in Sugar Creek supported a larger number of species than similar structures in Ashemore Creek. And although diversity did not differ between artificial and natural riffles in 1st and 2nd order streams, artificial riffles in Sugar Creek were characterized by higher diversity. Percent similarity of fish assemblages between artificial and natural riffles was higher for the 1st order (Ashemore Creek). All trends suggest that stream order must be taken into consideration when anticipating the benefits of installing artificial structures to improve stream habitat quality. This research should allow for 1) assessment of artificial riffles for aquatic habitat restoration, 2) evaluation of the economic practicality of this type of restoration, and 3) supply data to aid in the management of streams.

- 54 KRAL, LEOS. University of West Georgia—Multigenic analysis of the Tallapoosa darter population structure.

The Tallapoosa darter (*Etheostoma tallapoosae*) is endemic to the piedmont portion of the Tallapoosa River system that spans western Georgia and eastern Alabama. Analysis of mitochondrial DNA sequences had shown that the Tallapoosa darter population is subdivided into genetically divergent populations ($F_{ST} = 0.985$) classified as management units (MUs) for monitoring. To assess the degree of nuclear allelic diversity among these populations, twelve exon primed intron-crossing (EPIC) PCR primer pairs were designed that amplify portions of six single copy genes. The twelve PCR products range from 750 base pairs to 1,500 base pairs representing a total of about 10,000 base pairs of nuclear DNA. Analysis of these nuclear sequences reveals that nuclear allelic diversity is mainly partitioned among the genetically divergent populations previously defined as MUs. The EPIC PCR primer sets developed for this study have also been shown to amplify orthologous sequences from other *Etheostoma* and *Percina* species and thus should be of utility to a multigenic analysis of darter phylogeny. A web site has been established to act as an organizing center for a collaborative multi lab consortium to utilize these EPIC PCR primers for that purpose: www.dartergenomics.org.

- 55 RAKES, PATRICK L. AND J. R. SHUTE. Conservation Fisheries, Inc.—Propagation of the warrior darter, *Etheostoma bellator*, as a surrogate for the endangered vermillion darter, *E. chermocki*.

In a project funded by the Southeastern Imperiled Fishes Management program of the Southern Rivers Conservation Initiative of the National Fish and Wildlife Foundation, techniques were developed to captively propagate warrior darters, *Etheostoma bellator*, as surrogates for the critically imperiled (Endangered) vermillion darter, *E. chermocki*. The primary goal of the effort was to develop propagation protocols for the vermillion darter in the event that maintenance of ark populations becomes necessary to prevent extinction of the species. A secondary anticipated product would be elucidation of reproductive biology and early life history characteristics relevant to conservation of wild populations. Warrior darters began spawning in aquaria at CFI in late February at a photoperiod of 11.5 hours of light and water temperatures around 13°C. Spawning continued until mid-June, after photoperiod had been gradually advanced to 14 hours of light and water temperatures increased to about 21°C. As observed for other members of the subgenus *Ulocentra*, warrior darters attached eggs to a variety of hard surfaces, employing an “Easter egg” strategy of hiding eggs individually over a wide area. Larvae were only 5.5-6.0 mm TL at

swim-up and strongly pelagic for 30-40 days. These characteristics increase propagation difficulty, but techniques were developed to incubate eggs *in situ* and passively collect larvae from spawning tanks into larval rearing tubs. These techniques have subsequently been successfully applied to propagation of a variety of other darter species at CFI.

- 56 RAKES, PATRICK L.¹, SHUTE, J. R.¹ AND PEGGY W. SHUTE². Conservation Fisheries, Inc.¹ and Tennessee Valley Authority²—Successful reintroduction of endangered fishes to Abrams Creek, Great Smoky Mountain's National Park.

A project to restore populations of four rare fishes into Abrams Creek in the Little Tennessee River system has been underway now for 20 years. These fish, all on the U.S. Endangered Species List as endangered or threatened species, include: smoky madtom, *Noturus baileyi* (endangered); yellowfin madtom, *N. flavipinnis* (threatened); duskytail darter, *Etheostoma percnurum* (endangered); and spotfin chub, *Erimonax monachus* (threatened). Captive propagation and reintroduction and annual, non-invasive monitoring techniques were used for this restoration effort. By the end of 2002, a total of 3,147 smoky madtoms, 1,542 yellowfin madtoms, 3,430 duskytail darters and 11,367 spotfin chubs had been stocked into Abrams Creek. The smoky and yellowfin madtoms were stocked since 1986. Smoky madtoms have been stocked annually, and yellowfin madtoms periodically. Duskytail darters were stocked annually (except 2000) since 1993. Spotfin chubs were originally translocated from the upper Little Tennessee River in 1986; captively produced individuals have been stocked periodically since 1994. By summer 2000, there was evidence that all four species had reproduced in Abrams Creek. Abundance indices calculated from snorkel surveys at the reintroduction sites indicated increasing sizes for populations of three of the four fishes, and smoky madtom and duskytail darter abundances were nearly comparable to those in Citico Creek, the source for the reintroductions. Population dispersal over more than three creek miles from a stocking site was observed for both madtoms in 2004.

- 57 HOWELL, J. HEATH AND BERNARD R. KUHAJDA. University of Alabama, Tuscaloosa, Alabama—Life history characteristics of the Alabama darter (*Etheostoma ramseyi*) in Blue Girth Creek, Alabama

The Alabama Darter (*Etheostoma ramseyi*) is a widespread and common species endemic to the Mobile Basin. It is found in tributaries of the Cahaba and Alabama river systems, as well as direct tributaries of Mobile Bay. *E. ramseyi* is a member of the subgenus *Ulocentra* which contains small (65 mm standard length), colorful, snubnose darters. Specimens collected from Blue Girth Creek, a sandy, coastal plain, second-order tributary to the Cahaba River in Bibb County, Alabama were evaluated to determine life history characteristics. Most of the collections were made from July 1987 to April 1989, with additional collections from 1974, 1993, and 2005. In Blue Girth Creek, *E. ramseyi* was generally collected in raceways and flowing pools. Standard length was significantly correlated with body mass ($R^2=0.9724$). Sex ratio was 1.25 females for 1 male. Length frequency distribution revealed four different age classes. Examination of gonads indicated that spawning occurs from March to May. Analysis of stomach contents indicated feeding characteristics and diet breadth that is consistent with other members of the subgenus *Ulocentra* which typically consume larvae of flies, stoneflies, mayflies, and caddisflies.

- 58 BENNETT, MICAH G. AND BERNARD R. KUHAJDA. University of Alabama, Tuscaloosa, Alabama—Life history of the black madtom, *Noturus funebris*, in Blue Girth Creek, Cahaba River, Alabama

The black madtom, *Noturus funebris*, is a diminutive catfish [maximum standard length (SL) 124 mm (ca. 5 in.)] found throughout the southeastern United States. Life history

aspects of *N. funebris* were examined using 298 specimens from Blue Girth Creek, a sand-bottomed second-order tributary to the Cahaba River in Bibb County, Alabama, collected from July 1987 to September 1988. In Blue Girth Creek, *N. funebris* was associated with undercut banks, root masses, and aggregations of debris and sticks. Examination of \log_{10} length/weight relationships for individuals greater than 18 mm SL showed a strong linear relationship ($R^2 = 0.9947$) as expected. Length frequency data indicated four size (age) classes with most individuals in the 0+ and 1+ classes. Analysis of gonads indicated a reproductive season from May to August. Only one nest of *N. funebris* was collected in July 1988 in a glass bottle with 70 eggs. In summer 2005, placement of 30 clay flowerpots as in-stream artificial nesting cavities yielded no additional nests, indicating a preference for smaller, closed cavities. Male secondary sexual characteristics were examined for differences between breeding and nonbreeding specimens. Of four morphometric characters examined (max. head width, max. head depth, upper lip width, upper lip depth) only upper lip depth was significantly different for 18 breeding and 18 nonbreeding males ($p = 0.022$). Preliminary analysis of stomach contents indicated a similar diet to other *Noturus* species which consisted mainly of decapods and larvae of flies, mayflies and caddisflies.

- 59 BILLINGTON, NEIL. Troy University—Whole-molecule mitochondrial DNA RFLP variation in walleye and sauger.

Whole-molecule mitochondrial DNA (mtDNA) restriction fragment length polymorphism (RFLP) data from >1,200 walleye (*Sander vitreus*) and >100 populations across its North American range reveal >43 haplotypes that separate into five main geographic groups. Three of these groups can be related to post-Pleistocene recolonization events (fish from Atlantic, Mississippian and Missourian glacial refugia). The forth group consists of a unique and genetically divergent Mobile drainage haplotype. The fifth geographic grouping consists of a mixture of relic haplotypes found in the Upper Ohio River system, the New River, and the Rockcastle River, along with haplotypes of fish stocked into these areas more recently. Some haplotypes show a more localized distribution, which may serve as markers for stock identification. A smaller database (135 fish, 17 populations) exists for sauger (*S. canadensis*), but which covers its entire North American range, reveals little genetic variation in sauger (only 5 haplotypes) and shows little geographic structure. These results are consistent with sauger using a single (Mississippian) Pleistocene glacial refugium. These data will provide a useful starting point for decisions concerning the management and conservation of these two percid species.

- 60 BARR, AMY, RACHAEL N. KOIGI, RONALD E CREECH, JANET GASTON, AND NEIL BILLINGTON. Troy University—Genetic variation in sauger populations determined by protein electrophoresis.

Sauger (*Sander canadensis*: Percidae) are a piscivorous fish species that are popular with anglers in the Great Plains region, the mid-west and the southeastern US. In contrast to its congeneric species the walleye (*S. vitreus*), little work has been conducted on genetic variation in sauger. We screened genetic variation in 997 saugers by cellulose acetate electrophoresis at 25 protein coding loci in populations from the Great Plains (Saskatchewan, Canada, and Montana) and the mid-west (South Dakota and Iowa). Three loci were polymorphic in sauger: esterase (*EST**), phosphoglucomutase (*PGM-1**) and super oxide dismutase (*SOD-2**), but *PGM-1** only revealed rare heterozygotes. Significant population heterogeneity was found among populations at *EST** and *SOD-2*; genetic variation at *SOD-2** was restricted to Missouri River populations. Populations in Montana showed moderate population subdivision ($F_{ST} = 0.116$) and several populations showed significant deviations from Hardy-Weinberg expectations, all due to heterozygote deficits, likely caused by inbreeding ($F_{IS} = 0.259$) or drift. The three South Dakota populations were not significantly different from each other, likely due to gene flow down

the Missouri River system. These data represent the first study of genetic variation in these sauger populations and should provide valuable information for their management.

- 61 CIRTAINT, MARGARET C. AND SCOTT B. FRANKLIN. University of Memphis–
Impact of selected environmental parameters on *Arundinaria gigantea* canebrake establishment and reintroduction.

Reintroduction of a declining population requires a thorough understanding of environmental parameters most greatly affecting establishment. The *Arundinaria gigantea* (Walt.) Muhl. canebrake, once a dominate southeastern ecosystem, provided habitat for a number of animal species. A greater than 98% decline in the *A. gigantea* population has resulted in a critically endangered ecosystem, impacting many species. Thus, canebrake restoration is necessary for maintaining and enhancing biodiversity in the southeastern United States. The goal of this study was to facilitate reestablishment of *A. gigantea* canebrakes by examining environmental parameters critical to establishment (competition, light levels, soil moisture, and nutrients). My treatments for critical parameters are (1) reducing the forest canopy, 2) limiting competition, and 3) fertilizing could improve restoration efforts. Field studies using transplants and laboratory experiments are being conducted to determine conditions necessary for establishment and growth. Thinning sites have been established at two locations with forest canopy reduced by girdling overstory trees. Transects have been established to monitor population growth for both control and treatment sites. Competition and nutrient experimentation plots have been established at two locations. Plots of transplanted cane have been treated with landscape fabric for competition studies and applications of fertilizer for nutrient studies. Laboratory experiments are testing shading and nutrient effects on seedling growth. Results indicated thinning the forest canopy may increase *A. gigantea* population density, while competition has little effect; plant growth was increased in moist, well-drained soil with fertilizer supplementation.

- 62 MILLER, BRADLEY W. and TOM FOX. Virginia Polytechnic Institute and State University–The long-term effects of phosphorus fertilization on soil phosphorus availability.

Phosphorus (P) is one of the most limiting nutrients in forest soils. The concentrations of inorganic P in soil solutions are low because P is rapidly sorbed to soil colloids. Phosphorus fertilization increases plant available or "labile" P after fertilization; however it is uncertain how P fertilization influences organic and inorganic P pools over the long term in forest soils. Site specific properties such as above- and belowground biota, soil organic matter, and mineralogy can have large influences on P availability. The goal of this project is to determine how site preparation, vegetation control, and fertilization affect P pools twenty years after fertilization at four sites in the southeastern US. Soil samples were collected to one meter in loblolly pine plantations established on well- and poorly drained sandy and clay soils subjected to low and high intensity site preparation. Phosphorus pools were quantified using the Hedley sequential fractionation procedure for noncalcareous soils. This procedure determined total P, "labile" P, "moderately labile" P, and recalcitrant P pools. Fertilization increased levels of total P regardless of site preparation intensity and drainage class compared to unfertilized soils. After twenty years, labile P pools remained significantly higher in fertilized plots compared to controls in sandy coastal plains soils. Results from this research will help our understanding on the long-term affects of forest fertilization prescriptions on P pools. Implications of this research suggest that historical applications of P fertilizers in the southeastern US has had long-term effects on labile P pools.

- 63 STEVENS, M. HENRY H. Miami University–Placing local plant species richness in the context of environmental drivers of metacommunity richness.

Ecologists seem poised to reap the benefits of recent work examining the effects of energy and resources on plant taxonomic richness in local communities. The model presented here makes qualitative predictions of local plant species richness based on previous work regarding (i) correlations between temperature, precipitation and richness, (ii) correlations between soil nutrient availability and richness derived from both descriptions and experimental manipulations, and (iii) empirical demonstrations of the importance of the species pool in regulating local species richness. The model borrows part of its structure from spatially implicit metapopulation models. It makes the following five testable predictions. (i) Local richness increases linearly with immigration rate of new species and curvilinearly with local extinction rate. (ii) The effects of altered local immigration and extinction rates will be most apparent in local communities embedded in species-rich metacommunities. (iii) Local communities are not saturated, but rather increase in richness directly with increasing metacommunity richness. (iv) Unimodal or hump-shaped productivity-richness relations arise when low water or temperature limit diversity at low productivity and mineral nutrients limit diversity at high productivity. (v) An apparent scale-dependence of the effect productivity on richness should arise when there exists a matching scale-dependence of the underlying environmental drivers. These predictions do not contrast sharply with available data, but remain largely untested; such tests have the potential to synthesis our understanding of major patterns of biodiversity that are currently thought to exist at different spatial scales.

- 64 ERVIN, GARY N. Mississippi State University—Temporal scaling of the native-exotic species relationship mediated by microhabitat features and heterogeneity.

Although current hypotheses regarding mechanisms influencing invasiveness and invasibility in natural ecosystems are incompletely developed, interpretations of interactions between native and invasive species suggest that spatial and temporal dynamics may influence the perceived outcome of such interactions. Data collected at small scales suggest that competitive exclusion may reduce invasion success, whereas data from larger scale studies point to habitat heterogeneity as a primary factor enabling the establishment of invaders. The present experimental field study utilized naturally recovering wetlands at periods from 0 to 3 years following disturbance to evaluate the relationships of the native and exotic plant assemblages to biotic and abiotic components of the microhabitat, including microhabitat heterogeneity. Correlations among these parameters were examined during the first growing season following disturbance (small temporal scale) and compared with identical analyses across the full three-year chronosequence (large temporal scale). Results demonstrated a shift in the exotic species-native species relationship, with these suites of species negatively correlated at the smaller temporal scale but positively correlated at the larger scale. Correlations between microhabitat and species richness suggested that habitat heterogeneity enhanced native species richness at the small temporal scale, which subsequently decreased invasion success. At the larger scale, habitat heterogeneity appeared to facilitate both native and exotic species, with the highest richness of each group being collocated in more heterogeneous plots and in the absence of dominant native species.

- 65 GILLIAM, FRANK S. Department of Biological Sciences, Marshall University, Huntington, WV 25755—Response of the herbaceous layer of forest ecosystems to excess nitrogen deposition.

This review brings into focus what is known about the response of the herbaceous layer of forest ecosystems to increasing N deposition. The emphasis on forests is important because forests often occupy areas receiving high rates of atmospheric deposition of N and generally display greater biological and structural complexity compared to herb-dominated communities, about which much is known regarding response to excess N.

The focus on the herbaceous layer is warranted because most of the species diversity of forests occurs in this stratum. Most responses of forest ecosystems to N saturation, defined here as ecosystem supply of N exceeding ecosystem demand for N, can be characterized by two complementary hypotheses. One focuses on ecosystem processes (e.g., NPP), whereas the other addresses seasonal patterns of concentrations of NO_3^- in stream water. Although neither hypothesis considers the effects of chronically-elevated N deposition on forest herbs, both share a prediction—a dramatic increase in availability of NO_3^- —that is relevant to forest herb response. Whereas European studies of N effects on forest herb layers generally employ N-deposition gradients, North American studies more commonly use plot-based experimental N additions. Despite their differing approaches, both groups of studies generally find similar results, i.e., excess N deposition significantly reduces species richness of the herbaceous layer. Several mechanisms potentially interact to cause this, including decreases in mycorrhizal fungi and competitive abilities of N-efficient herbaceous dominants, and increases in herbivory, fungal pathogens, and invasive species. Thus, an additional symptom of N saturation in forest ecosystems would be decreased biodiversity.

- 66 KUPPINGER, DANE M., PETER S. WHITE, AND MICHAEL A JENKINS. University of North Carolina at Chapel Hill, University of North Carolina at Chapel Hill, National Park Service, Great Smoky Mountains—Xeric forest seed banks in the Great Smoky Mountains National Park: The presence of the exotic *Paulownia tomentosa* and implications for management.

National parks across the country are charged with protecting native plant communities. These communities are both dynamic and complex, changing in response to many factors including disturbances. The identification (via germination) of species present in the seed bank enables better predictions about a community's response to future disturbance and whether this may facilitate the invasion of exotic species. My study analyzed the contents of xeric forest seed banks (through seed germination) in the western portion of the Great Smoky Mountains National Park and the distribution of *Paulownia tomentosa* seeds within them. We found that although *P. tomentosa* seeds were found within the seed bank, their presence was strictly limited to the outer portions of the park. Comparing seed bank species composition with above ground composition suggests that banking is an important strategy for only a portion of the species found in the community. Given the difficulty of identifying the source of collected seeds, to date few studies of seed dispersal patterns have been conducted. Studies of exotics like *P. tomentosa* represent a novel way to investigate these patterns.

- 67 MARCINKO, SARAH E AND JOHN L RANDALL. The University of North Carolina at Chapel Hill—Reproductive biology and conservation implications for the federally endangered, *Ptilimnium nodosum* (Apiaceae)

Studies of plant reproductive biology are of particular importance to conservation biology and provide considerable insight into a plant population's genetic structure. The effects of random events and inbreeding depression can be more or less detrimental depending on the breeding system, which can either reduce or increase a species' susceptibility to extinction. *Ptilimnium nodosum*, or harperella is a federally endangered plant with only 13 remaining populations, all within the eastern U.S., yet its mating system is unknown. We performed controlled crosses as well as pollen viability and stigma receptivity treatments in 2005. In contrast to previous studies, which have inferred that *P. nodosum* is selfing, our results suggest that the species is predominantly outcrossing and protandry may be a sufficient mechanism in eliminating self-fertilization. In addition, a rapid decline in pollen viability coupled with a short window of stigma receptivity is evidence for self-incompatibility. Furthermore, low seed establishment in a frequently disturbed habitat has made vegetative propagation the primary means of reproduction and can produce

genetically homogenizing effects. Our results pose critical challenges to conservation given that the opportunity for successful pollination is reduced in small, patchy populations.

- 68 NAPLES, BRENDAN AND MELANY FISK. Appalachian State University—Fungal responses to localized nutrient heterogeneity in a northern hardwood forest.

Nutrient limitation may be shifting in northeastern forests due to decades of anthropogenic nitrogen (N) emissions and acidic deposition. In forests where growth has historically been limited by availability of nitrogen, deposition has enhanced N availability but reduced availability of cations, such as calcium (Ca), and subsequently reduced phosphorus (P) availability due to lower soil pH. A low Ca supply appears to limit mycorrhizal fungus colonization, further impeding P nutrition. My study addresses the impacts of varying nutrient environments on fungal community composition and enzyme activity. We predicted that roots and fungi would preferentially colonize P or Ca cores over N or control cores, thus enabling us to infer limitation by these nutrients. The ingrowth core method was used by replacement of 5 cm diameter soil cores with N, P, Ca, or sawdust amended, uniform root-free mixtures of soil. Cores were established in replicate northern hardwood forest stands in the spring of 2005 and harvested after one growing season. Roots and fungal DNA have been extracted and enzymes assayed. Fine root length, mycorrhizal colonization, fungal community composition and biomass, and enzyme activity are currently being quantified. The fungal community is being characterized using molecular genetic methods. Analysis of fungal communities and enzyme assays will be discussed.

- 69 SIDES, KATHERINE¹, COLLEEN IVERSEN², AND RICHARD NORBY¹. Oak Ridge National Laboratory¹ and the University of Tennessee²—Soil carbon efflux and belowground processes under elevated CO₂ and nitrogen fertilization.

The processes controlling carbon exchange between terrestrial ecosystems and the atmosphere are being increasingly explored as atmospheric CO₂ concentration rises due to human activity. At ORNL Free Air CO₂ Enrichment (FACE) experiment, soil carbon efflux from root and microbial respiration returns CO₂ to the atmosphere at an increased rate under higher CO₂ levels. We observed a 22% increase in soil C efflux in elevated CO₂ plots relative to ambient plots in a closed-canopy deciduous forest. Factors contributing to this CO₂ feedback may be related to increased fine-root production, which could lead to increases in fine-root decomposition, rhizosphere activity, and microbial biomass. Soil cores were removed directly below sites of soil C efflux measurements and analyzed for root mass, root length by diameter class, and microbial biomass. At an adjacent site we found that nitrogen additions to soil decreased soil C efflux by 27%. Soil cores are being examined to determine the relative influences of root and microbial activity. Evaluating *in situ* root and microbial biomass under these two experimental conditions will increase our understanding of the soil C efflux process.

- 70 HUBER, AMY¹, AMY GASKELL², CHRISTOPHER WORRELL³ LARRY ROGERS³ AND MARTIN CIOLLINI³. Miami University of Ohio¹, Stephan Austin University² and Berry College³—Estimation of total biomass in a Mountain Longleaf Pine ecosystem in northwestern Georgia.

The goal of this research was to estimate total biomass in five Mountain Longleaf Pine (*Pinus palustris*) stands at Berry College in northwestern Georgia. In comparison with other southern pines, Longleaf Pine has a higher density and longer life span, and is thus better able to sequester large amounts of carbon from the atmosphere over the long term. Much interest has gathered recently in evaluating the role of carbon storage in Longleaf Pine forests as a means of moderating the global rise in atmospheric carbon dioxide, and in the restoration of fire-suppressed Longleaf Pine communities in general. Because there

are no standard methods of evaluating total biomass that are specific to the Mountain Longleaf Pine ecosystem, it was necessary to correct commonly used methods to reflect local conditions. Estimates for carbon storage were made using the standard U.S. Forest Service fuel load methods for all biomass components except trees taller than 10 ft. Correction factors were developed for downed woody biomass components based upon actual biomass values generated from fixed plots. For trees taller than 10 ft, point-centered quarter methods coupled with published allometric equations were used to estimate biomass. Total biomass, which was dominated by trees taller than 10 ft., litter, and duff categories, ranged from 72 tons/acre (in a recently burned stand) to 176 tons/acre (in a relict stand with no record of recent fire).

- 71 HUDSON, SHERI L., MARGARET CIRTAINT, AND SCOTT FRANKLIN.
University of Memphis—Vegetative Propagation of *Arundinaria gigantea*, North America's Only Native Bamboo, Using Cut Culms.

Monoculture stands of *Arundinaria gigantea* (Walt.) Muhl. form ecologically important canebrakes, due to the diversity of fauna that rely on this habitat. This native bamboo has been devastated by various anthropogenic factors, which, combined with lack of sexual regeneration, have rendered a 98% decline and a critically endangered ecosystem. The purpose of this study is the reestablishment of canebrake habitat. However, with no seed, and limited success with rhizome transplantation, a method of multiplying individuals for planting new sites must be developed. My objective was to determine if macropropagation, a form of vegetative propagation, can be a feasible method for multiplying individuals for reintroduction. To that end, I developed a replicated greenhouse experiment in which each tray was equal to a replicate. Cuttings were standardized at 40 cm lengths with diameters ranging from 8 – 14 mm. Cuttings were soaked in various IBA, coumarin, and control treatments for two hours before being placed in prepared sand trays. Watering was accomplished with a misting system every eight hours around the clock. Cuttings taken during the dormant period had better shoot initiation than cuttings taken during the period of active growth. There was a significant difference in the numbers of new shoots resulting from treatments containing coumarin and those in the control and IBA only treatments. Macropropagation is less labor intensive than rhizome transplantation and has the potential for development of more propagules than direct seeding.

- 72 PAGEL, ALISHA L.¹, JAY GARLAND², FRANK P. DAY¹, BRUCE HUNGATE³,
J. PATRICK MEGONIGAL⁴, KAREN CARNEY⁴, AND BERT DRAKE⁴.¹Old
Dominion University, ²Dynamac Corporation, Kennedy Space Center, ³Northern
Arizona University, and ⁴Smithsonian Environmental Research Center—Microbial
community function altered by elevated atmospheric CO₂ in Florida scrub-oak
soil and leaf litter

Soil microbial communities mediate many important ecosystem processes, including organic matter mineralization. Changes in the environment that affect microbial community composition may lead to differences in decomposition rates. Here, we examined whether elevated atmospheric CO₂ affected soil microbial function in a Florida scrub-oak ecosystem. Application of elevated atmospheric CO₂ to the ecosystem is unlikely to directly affect soil microbes. Instead changes may be mediated through plant responses to elevated CO₂, such as changes in litter deposition or rhizosphere exudates, which can alter microbial function. To detect differences in microbial activity, a novel technique, the Oxygen Biosensor system, was used to examine the soil microbial function in an elevated atmospheric CO₂ study of Florida scrub-oak ecosystem. This technique allows the observation of O₂ consumption rates for microbes utilizing different energy sources and exposed to various nutrient treatments. This system has enabled the differentiation of microbial community by habitat type (litter, bulk soil and rhizosphere) and by CO₂ history

(elevated = 700 ppm, ambient = 350 ppm). The use of natural substrates (leachates from plant material) for microbial energy sources in the Oxygen Biosensor system has shown shifts in the function of soil microbes under elevated CO₂ treatment. The use of nutrient additions has also demonstrated a change in microbial community response and nutrient limitation under elevated atmospheric CO₂. Altered microbial function has potential to affect long-term soil carbon storage dynamics.

- 73 ROLIG, MARTA, JEFFREY L. WALCK AND SITI N. HIDAYATI. Middle Tennessee State University—Effects of herbicides and fertilizers on seed germination of two rare *Paysonia* species (Brassicaceae).

Paysonia perforata (Rollins) O'Kane & Al-Shehbaz and *P. stonensis* (Rollins) O'Kane & Al-Shehbaz are winter annuals endemic to Tennessee. They frequently grow in agricultural fields where herbicides and fertilizers are applied in spring when seeds are dormant and in summer when seeds are undergoing dormancy release. Non-herbicide treated seeds of *P. perforata* germinated to 92%, but glyphosate (burndown and postemergent herbicide) treated or atrazine (pre- and postemergent herbicide) treated seeds germinated to 53-60% with spring application and 77-94% with summer application. Seeds of *P. stonensis* germinated to 73-91% regardless of the type of herbicide and time of application; control seeds germinated to 72%. Germination percentages were higher when seeds of both species were incubated on KNO₃, NH₄NO₃, and NaNO₃, simulating fertilizer application, than on water; KCl did not affect germination. *Paysonia perforata* seeds treated in spring with 0.5-5.0 g/L KNO₃ germinated to 29-60 and 14-16% in light and darkness, respectively. However, seeds exposed to light in spring and treated with KNO₃ in summer germinated to 52-92 in light and 33-90% in darkness. When KNO₃ was applied to *P. stonensis* seeds in spring, they germinated to 27-97 and 22-74% in light and darkness, respectively, and when applied in summer, they germinated to 28-30 and 54-85%, respectively. In conclusion, seeds of *P. perforata* are more sensitive to herbicide and fertilizer application than those of *P. stonensis*, causing a decrease of germination during spring herbicide treatment and an increase in dark germination during summer fertilizer treatment potentially influencing the capacity of the species to form a soil seed bank.

- 74 COLE, PATRICE. The University of Tennessee, Knoxville—The non-native grass, *Microstegium vimineum*, suppresses woody seedling recruitment in understory habitat.

The non-native grass *Microstegium vimineum* (Gramineae) is established throughout the eastern United States. The open understory characteristic of forested habitats dominated by *M. vimineum* suggests that this grass may be suppressing woody seedling recruitment. As mature trees in these habitats die, the absence of woody species seedlings and saplings could result in gaps in forest cover dominated by *M. vimineum*. Although shade-tolerant, *M. vimineum* thrives in high light environments. Seed dispersal would likely enlarge the gap in forest cover and create additional populations farther into surrounding understory habitat. In this scenario, large areas of forest might be converted to open grassland dominated by this non-native species. I conducted a 2-year field experiment to test the hypothesis that *M. vimineum* suppresses woody seedling recruitment by reducing light at the soil surface. Fifteen 1-m² plots were established in an understory site dominated by *M. vimineum*, and all plants were removed from 10 plots. Seeds of 5 native tree species were planted into each of the 15 plots. Five of the plots from which *M. vimineum* had been removed were covered with shade cloth of a density that resulted in light reduction comparable to that beneath the intact *M. vimineum*. Seedling emergence and survival were monitored through 2 growing seasons. Seedling survival and the number and biomass of other woody and herbaceous species were greater in the unshaded removal plots than in the other plots. These findings indicate an urgent need for control of *M. vimineum* to avoid significant loss of forested ecosystems.

- 75 GADD, LAURA AND JON STUCKY. North Carolina State University—Pollination biology of *Echinacea laevigata* (Boynton and Beadle) Blake, Smooth Coneflower, in small, isolated populations.

Pollination limitation can reduce seed number and seed quality in small, isolated plant populations. *Echinacea laevigata* (Boynton and Beadle) Blake, a federally endangered species, occurs in several small, isolated populations and a single large population in the northern Piedmont of North Carolina. We conducted a study of insect flower visitation and seed production in these populations to test our hypothesis that plants in the small, isolated populations are visited by fewer insect taxa, receive fewer visits, and produce fewer and/or less fit seeds than do plants in the large population. Our data show that average insect visitor species richness was significantly greater in the large population than in small populations and all but one of the small populations had fewer pollinator visits per head during fifteen minute observations than the large population; however, plants in several small populations produced as many or more seeds per head than did plants in the large population. Additionally, preliminary results suggest that seeds from small populations produce seedlings equally fit as those from the large population. Therefore, our results were not consistent with expectations of pollination limitation. We conclude that factors not examined in this study are more threatening to small, isolated coneflower populations than is pollination limitation.

- 76 LALIBERTE, LORRIE AND JAMES LUKEN. Coastal Carolina University—Plant distribution along the rims of Carolina bays in Horry County, South Carolina.

One of the most intriguing wetlands of the Atlantic Coastal Plain is the Carolina bay, a shallow, elliptical basin. A subtle topographic gradient ranging from wet peatlands to dry sand rims and pine savannas often surrounds Carolina bays. The transitional area has been identified as important habitat for rare plants, several of them endemic to the Carolina Coastal Plain. Many of the bays in South Carolina have been impacted, severely disturbed, or lost. We examined the distribution and diversity of plant communities in relation to environmental variables and jurisdictional wetland boundaries within, among, and surrounding six Carolina bays in Horry County, South Carolina. Diversity was lower and less variable within bays than the edges. Hydrologic and soil properties were also evaluated and relative elevation of each vegetation sampling plot was measured. Statistical analyses were conducted to determine similarities and differences within and between bays, especially along the wetland/upland interface. Information gained with these methods may be used to develop management guidelines that will protect both Carolina bays and the rare plants associated with them. This research also provides information on the correlation between wetland plants and jurisdictional wetland boundaries. Given that the jurisdictional wetland boundary often is not uniform across the three criteria measured, a buffer around the wetland would be an ideal way to protect rare or threatened plants in this transitional zone. Although this study focused on Carolina bays, these methods could be used in other wetland types on the Coastal Plain, particularly other isolated wetlands.

- 77 MCMILLAN, BRETT A. AND FRANK P. DAY. Old Dominion University—Determinants of floristic structure on the 'pimple' dunes of Virginia's barrier islands.

'Pimples' are peculiarly circular dunes found on the barrier islands that are part of the Virginia Coast Reserve Long Term Ecological Research site (VCR LTER). Although pimples are typically <1.5 m higher than the elevation of the surrounding marsh and only 10-40 m in diameter, they may support several distinct vegetation zones. We are studying plant assemblages on pimples and the environmental factors influencing them, principally

aspect, slope, elevation, depth to fresh water, and nutrient availability. Furthermore, pimples appear to be semi-isolated dune 'islands' within the barrier islands, and we are determining the extent of their similarity to larger dunes so that they may be used as natural mesocosms for studying upland ecology on the VCR barrier islands. We have used multivariate analyses of floristic structure on pimples to describe in greater detail the importance of the interaction of water table and elevation in determining species distribution. Not surprisingly, water level best explained distribution of most hydrophytes, whereas height above marsh explained presence of xerophytes. Nevertheless, some plants heretofore considered belonging to marsh or dune appeared more plastic in their habitat preferences. Other seemingly generalist species were found to prefer specific aspects, i.e., eastern vs. western exposure. This probably reflects the importance of exposure to salt spray or winds from the ocean. Continuing collection and analysis of soil nutrient, water quality, and water availability data has elucidated factors that create microhabitat differences on these dunes and determine small scale distributions of individual species.

- 78 MORETZ, C. CRAIG AND MILES R. SILMAN. Wake Forest University—A three year demographic study on the tropical orchid *Phragmipedium caudatum* in southeastern Peru.

Phragmipedium caudatum is an endangered neotropical orchid (CITES Appendix I) with a distribution ranging from Guatemala to Peru. Over a three year period from 2002 to 2004 demographic data were collected from a population of *P. caudatum* growing at 2400m a.s.l. in the southeastern mountains of Peru (Department of Cuzco). Results indicate that the total number of individuals decreased 38% over the three year study period. Removal of mature individuals by humans appears to be the underlying cause of decline. The time from seedling (ramets \leq 5cm in height) to flowering size plant (ramets \geq 30cm in height) was determined to be two years, which is less than half the time it takes for plants grown under optimal conditions in cultivation. Despite a 38% decline in total number of individuals over the three year study period, flower production in 2004 was only slightly less than in 2002 and capsule production (i.e. seed production) was 392% higher in 2004 than in 2002. Age class structure among ramets was the same in 2002 and 2004, though the intervening year, 2003, had a drastically different age class structure among ramets.

- 79 SCARBOROUGH, ANGELA R. Central Missouri State University—Species assemblages of tree canopy myxomycetes related to bark pH.

Aerial pollution from acid rain and dry acid deposition contributes to tree injury and death at high elevation sites in Great Smoky Mountains National Park (GSMNP). The working hypotheses propose a relationship between species assemblages of corticolous myxomycetes and bark pH of different tree species and that study sites in GSMNP and Perle Springs, Warrensburg, Missouri will include rare or new myxomycete species. Three species of gymnosperm trees, *Abies fraseri*, *Picea rubens*, and *Juniperus virginiana*, and one angiosperm tree, *Quercus alba*, were climbed using the double rope climbing technique and sampled for bark at approximately 3 meter increments up to 12 meters. Laboratory moist chamber cultures were prepared using bark from living trees, measured for pH, and microscopically scanned for myxomycete plasmodia and fruiting bodies. Myxomycete species were identified using microscopic slide preparations. Seven rare and one possible new species were found. Results indicate some myxomycete species assemblages are restricted to an acidic pH range (3.0 to 4.0); others to a near neutral pH (5.5 to 7.0); still others span a pH from 4.0 to 7.0. *Juniperus virginiana* had the highest mean pH at 6.76, and *Picea rubens* had the lowest mean pH at 3.72; both had a distinctive assemblage of myxomycete species. No myxomycete plasmodia or fruiting bodies (zero species) were observed in bark cultures of *Abies fraseri*. Data recorded near

a biomonitoring station at Clingman's Dome suggest that canopy myxomycetes may serve as bio-indicators of aerial pollution at this high elevation site in GSMNP.

- 80 STOVER, DANIEL B.¹, FRANK P. DAY¹, JOHN R. BUTNOR² AND BERT G DRAKE³. Old Dominion University¹, U.S. Forest Service² and Smithsonian Environmental Research Center³—Utilization of ground penetrating radar to quantify the effects of elevated atmospheric CO₂ on coarse root biomass in a scrub oak ecosystem at Kennedy Space Center, FL.

The growth and distribution of coarse roots in time and space represent a major gap in our understanding of belowground ecology. Large roots play a critical role in the sequestration of carbon belowground. Ground Penetrating Radar (GPR) was used to investigate differences between coarse roots in a scrub oak ecosystem that has been exposed to elevated atmospheric CO₂ for the past nine years at Kennedy Space Center, Florida. GPR is a geophysical technique that utilizes electromagnetic waves (~100-1,500 MHz) transmitted directly into the ground, which then reflect off buried objects back to the receiving unit. The advantages of this non-destructive method include non-invasive, rapid acquisition of belowground data. In our study, we utilized a 1,500 MHz antenna to establish regressions between GPR signals and root biomass. A significant relationship exists between GPR signal reflectance and biomass ($R^2=0.7103$). This correlation was then applied to scans taken from the open-top CO₂ chambers. Our data suggest that plots receiving elevated CO₂ had significantly greater coarse root biomass compared to ambient plots. This implies that coarse roots may play a large role in the sequestration of carbon in a scrub oak ecosystem. Although still in its infancy, this method holds much promise for rapid and repeatable identification and quantification of coarse roots, which are currently the most elusive aspect of the long-term study of root systems.

- 81 BINKLEY, MEAGAN, KARA ALLEN, DEBORAH MCGRATH AND NATASHA COWIE. University of the South—The effects of Nepal Grass (*Microstegium vimineum*) on soil ecology on upland sites of southern Cumberland Plateau, Sewanee, Tennessee.

Nepal Grass (*Microstegium vimineum*) is an exotic shade tolerant C4 grass that has proliferated in natural and disturbed habitats throughout the southeastern United States. Nepal grass out competes native species through its apparent role as an invasive generalist, quickly establishing a monoculture and crowding out other plants. Some studies indicate that this grass changes soil chemistry and decreases plant diversity. Nepal grass is found in cleared areas as well as in mature forests. We wanted to determine if Nepal grass invasion could change the chemistry and micro-invertebrate ecology of upland soils of the southern Cumberland Plateau. We hypothesized that dense Nepal grass invasion would raise soil pH and nitrate concentrations, and decrease microinvertebrate abundance and diversity in the litter layer. On four sites of varying levels of disturbance and Nepal Grass density, we compared soil chemistry and litter microinvertebrate populations along transects. We found that Nepal grass does alter the relative abundance of some orders of litter invertebrates. Soil samples taken from areas where Nepal grass density was heavy had greater nitrate levels, although pH was not statistically higher, perhaps due to variability among sites that might mask such an effect. To address this issue, we are conducting a greenhouse experiment in which we compare the chemistry of native "homogenized" soil (0-5 cm depth) grown with and without Nepal grass through a complete annual lifecycle. Soils of both treatments did not differ chemically at the beginning of the study and we will sample soils after the grass has died and again in six months once decomposition is underway.

- 82 BOLIN, JAY F.¹, LYTTON J MUSSELMAN¹, AND KUSHAN U. TENNAKOON^{1,2}.
Old Dominion University¹ and University of Peradeniya, Sri Lanka²—A report of fruiting, germination, and seedling development of *Arundinaria gigantea* (Walter) Muhl.

Cane, *Arundinaria gigantea*, is common in the southeastern United States, but little has been reported about its basic biology; fruiting is unpredictable and may occur at 50 year intervals. We report a rare fruiting occurrence in a Chesapeake, Virginia cane brake. Fruiting occurred primarily in early May, 2005 and continued for about 60 days. Stand density ($1.75 \times 10^6 \pm 2.02 \times 10^4$ fruiting culms/ha), grains per culm (21.5 ± 1.4), and dry grain mass (36 ± 1 mg) were estimated. Based on these data, mastинг events must have been remarkable in the 'Green Sea' region of Virginia; we estimate dry mass grain production of 1,090 to 1,657 kg/ha. Germination trials showed approximately 40% success with no significant differences between light and dark treatments. Seeds were not viable after one month of air drying. Flowering culms ($n=29$) were tagged and revisited Sept. 1, 2005; 100% of culms and 79% of associated rhizomes were dead. Other cane brakes in the region showed no fruiting. Thus, this rare mastинг event appeared to be local and potentially clonal. Observations of seed dispersal and seed predators are also discussed.

- 83 RAY, AMANDA, TYLER POOLE, MICHAEL LAND AND FITZROY ORRITT.
Northwestern State University—Methodologies and determination of chemotherapeutic effects on methicillin-resistant *Staphylococcus aures*.

Determining the resistance of a microorganism to an antibiotic is routinely accomplished by utilizing the Kirby-Bauer antibiotic susceptibility method. While useful, this method yields little information on effective determination of minimal inhibitory concentrations (MIC) or the interactions of other in vivo factors that may enhance or inhibit an antibiotics effects on an organism. Methicillin-resistant strains of *Staphylococcus aures* obtained from clinical sources were subjected to an array of antibiotics using the Kirby-Bauer method. The antibiotics that indicated the best route of treatment were then subjected to traditional MIC determinations, a modified antibiotic sensitivity disc method the E-Test and in vivo interaction with fertilized chicken embryo assay techniques. A comparison of these techniques and their effectiveness with a quickly screened antibiotic was conducted and compared for the best method of recommending a chemotherapeutic agent for this serious microbial pathogen.

- 84 CHERRY, JAMIE, CODY COLE, MICHAEL LAND AND FITZROY ORRITT.
Northwestern State University—Methodologies and determination of chemotherapeutic effects on pathogenic *Candida spp.*

Determining the resistance of a microorganism to an antibiotic is routinely accomplished by utilizing the Kirby-Bauer antibiotic sensitivity test. While useful, this test yields little information on effective determination of minimal inhibitory concentrations (MIC) or the interactions of other in-vivo factors that may enhance or inhibit an antibiotics effects on an organism. Pathogenic *Candida spp* were subjected to antibiotics using the Kirby-Bauer method, traditional MIC determinations, a modified antibiotic sensitivity disc method the E Test and in-vivo interaction with fertilized chicken embryo assay techniques. A comparison of these techniques and their effectiveness was conducted and compared for the best method of assaying chemotherapeutic effectiveness on pathogenic yeasts.

- 85 GREEN, DAVID, JOSH BREITHAUPT AND MICHAEL LAND. Northwestern State University—Methods to reduce pathogen loads in reptiles using *Anolis carolinensis* as a model organism.

Reptiles are well known vectors for *Salmonella spp* as well as other enterics which can cause disease in humans. Reptiles are also popular pets and are often identified as vehicles of disease. The sale of red ear slider turtles in the united states has been banned because of illness due to *Salmonella spp*. Lizards are popular pets and can be purchased as exotics or common endemic species. To reduce the chance of infection due to enterics, *Anolis carolinensis*, the common green Anole, was studied as a model organism. Methodologies to rid the Anole of external and internal pathogens were devised and evaluated. These methodologies could be a recommended regime to reduce pathogen loads and allow these animals to be handled safely.

- 86 YRLE, FRANK, LUKE STORRS, DANIEL KLUCZNIK AND MICHAEL LAND.
Northwestern State University—Effects of *E. coli* O-157:H7 on *Xenopus* survival.

Escherichia coli O-157:H7 shed in bovine feces and subsequent survival in soil systems is dependent on many factors. *E. coli* O-157:H7 being a Gram negative bacteria should not survive for extended periods of time external to a host animal. However, *E. coli* O-157:H7 has been shown to persist in the environment and become a significant threat in run-off from agricultural lands. This pathogen can affect many species and its effect on developing aquatic species has not been investigated. *E. coli* O-157:H7 in varying concentrations were tested in a modified FETAX assay. The effects of this pathogen on developing tadpoles were investigated and their effects determined.

- 87 HORN, CHERYL, KASEY BELVA, SHANNON CAGLE, CRYSTAL HARSANY,
KEELY O'BRIEN, KATIE OWENS, NICOLE RUBERTI, AND HENRY SPRATT.
University of Tennessee at Chattanooga—Electrical current generation by soil
microbes inoculated with polycyclic aromatic hydrocarbon-exposed sediments.

Bacteria in the genus *Geobacter* are known to generate small electrical currents as they metabolize organic compounds in the presence of graphite electrodes. We hypothesize that a bacterial battery inoculated with a small amount of polycyclic aromatic hydrocarbon (PAH)-contaminated sediment, will metabolize PAH's and produce a small electrical current. A three-celled bacterial battery was constructed by adding PAH-contaminated riparian sediments from the Chattanooga Creek Superfund site in Chattanooga, Tennessee. A graphite electrode was embedded in the sediment to serve as metabolic electron acceptor (the anode). A cathode was placed in the aerated water above. Current was monitored in each battery cell using electric meters. Output from the battery cells was measured both prior to and following injection of (1) glucose, (2) naphthalene dissolved in methanol, and (3) methanol alone. Average current from the three cells following glucose injection peaked at 1.72 mA. Following the methanol-naphthalene injection average current peaked twice, at 1.5 and 1.6 mA, suggesting that microbes utilized methanol and naphthalene separately. The data showed a statistically significant increase in current following injections ($p<0.05$), suggesting that the soil microbes were able to metabolically degrade both glucose and naphthalene, generating electrical current. Efficiencies of carbon-to-current conversions for glucose and methanol-naphthalene mixture were 5% and 7% respectively. Such a process could have implications in remediation of PAH-contaminated soils, and in harnessing current for use in electrical devices to monitor the remediation. Studies on the ability of these bacterial batteries to metabolize additional PAH's are underway.

- 88 HETRICK, MARY¹, NITIN WARIER², DIETER KNOWLE², NARA GAVINI¹ AND
LAKSHMI PULAKAT¹. Mississippi State University¹ and Bowling Green State
University²—Pertussis toxin mediated inhibition of the angiotensin II receptor AT2
signaling via an independent Gi protein mechanism.

Infants are vulnerable victims of Whooping cough and neurological damage is often an after-effect among infected infants. The S1 subunit of Pertussis Toxin (PTx) that ADP-ribosylates cellular Gi-proteins and inhibits Gi-protein mediated signaling is a major contributor to the pathological effects of Whooping cough. The Angiotensin II receptor AT₂ is one of the molecules whose signaling is inhibited by PTx via ADP-ribosylation of the cognate Gi-protein. High-level expression of AT₂ is exhibited in infant brain implicating a role for this molecule in neuronal development. We show by yeast two-hybrid assay, that the S1 subunit can directly interact with the 3rd ICL and cytoplasmic tail of AT₂, the two regions that play an important role in signaling of AT₂. To further verify this interaction, a His-tagged S1 gene was cloned in plasmid pBG2501 and His-tagged S1 was overproduced in *A. vinelandii*. When lysates of Chinese Hamster Ovary cells, expressing AT₂ or its mutants were incubated with the His-tagged S1, only wild type AT₂ co-immunoprecipitated with S1. This result indicates that mutation of the 3rd ICL, or deletion of the C-terminus hindered the AT₂-S1 interaction and is consistent with the results from the yeast two-hybrid experiments. Taken together, these results imply that by directly interacting with the crucial regions for AT₂ signaling, S1 can sterically inhibit AT₂-mediated signaling. This observation points towards other mechanisms by which the S1 subunit can induce neuronal damage in infants and adds another factor that must be considered during the development of safe, acellular vaccines.

- 89 BRANDON, CLARK AND RAJ BOOPATHY. Nicholls State University–
Bioremediation of Explosive Contaminated Soil by Soil Bacteria.

Soil in many parts of the Louisiana Army Ammunition Plant (LAAP) in Minden, LA are contaminated with many explosive chemicals including 2,4,6-trinitrotoluene (TNT), Royal Demolition Explosive (RDX), and High Melting Explosive (HMX). An enrichment experiment using the contaminated soil along with glucose as a co-substrate was carried out to isolate indigenous bacteria. After isolating two pure cultures, the microbes were identified as *Bacillus laevolacticus* and *Staphylococcus cohnii* using the BIOLOG method. A laboratory study using the two indigenous isolates under various growth conditions indicated that the indigenous bacteria successfully degraded TNT in 5 days. However, these isolates did not degrade HMX and RDX. A soil slurry reactor study showed that the TNT could be successfully removed from the contaminated soil under co-metabolic conditions using molasses as co-substrate.

- 90 BENNETT, PHILIP, STEPHEN HALES, RON HIGGINS, LISA HUTCHINGS, DON SEDER, and HENRY SPRATT. University of Tennessee at Chattanooga -
Mineralization of the herbicide metolachlor by microbes in urban and rural streams.

Studies of microbial mineralization of the herbicide metolachlor in water and sediment collected from three Chattanooga, Tennessee streams were conducted during September and October 2005. Streams studied included Chattanooga Creek (draining a former heavily industrialized area, parts of which are recognized as an EPA Superfund site), North Chickamauga creek (draining mostly residential areas), and Falling Water creek (located on the outskirts of Chattanooga in forested and formerly agricultural areas). Water and sediment samples were collected from triplicate stations within each of the three streams. In the laboratory microcosms were set-up using either water or sediment/water slurries. Radiolabeled metolachlor (14C-ring labeled) was injected into all microcosms. A 0.1 N NaOH solution was used to trap 14CO₂ generated in microcosm headspace during incubations. Scintillation counting was used to quantify respired 14 CO₂. When water column bacteria were tested for their ability to mineralize metolachlor, no 14CO₂ was detected for any of the samples tested. When sediment/water slurries were tested, rates of metolachlor mineralization ranged from 100 to 150 ng/g/da. Sediments from North Chickamauga creek supported the highest mineralization rates, while

sediments from Falling Water creek had the lowest mineralization rates. These findings suggest that the use of herbicides in residential areas encourages development of larger populations of stream sediment microorganisms capable of mineralizing the herbicide metolachlor than either more rural, or contaminated urban stream sediments. Further study of the potential to enhance rates of metolachlor mineralization in the sediments tested, through the addition of inorganic nutrients, are currently underway.

- 91 CAMPBELL, MATTHEW, INIGO HOWLETT, JOSEPH NIHILL, JACOB SLACK, PETER THORNTON, AND HENRY SPRATT. University of Tennessee at Chattanooga - The effects of prior exposure and biostimulation on the mineralization of naphthalene from two wetland sites in southeastern Tennessee.

Rates of naphthalene mineralization by soil microbes were measured for soils from two sites having different prior exposure to polycyclic aromatic hydrocarbons (PAH). Chattanooga Creek flood plain soils have had PAH exposure due to coal coking activities dating to the late 1800's. Contaminated soils were collected from three stations located on the flood plain of Chattanooga Creek (CCK). Another Chattanooga site, on a floodplain of the Tennessee River (TR), with no known exposure to PAH's, was also sampled at three different stations. Soil/water slurries were prepared for all soils using Tennessee River water. Slurries and tracer-level amounts of ¹⁴C naphthalene were added to microcosms. Mineralization of naphthalene was monitored by quantifying 14CO₂ in 0.1N NaOH traps within the microcosms. Significantly higher rates of naphthalene mineralization were observed for CCK soils than for TR soils (1.44 vs. 0.36 μ g/g/da, t-test, p<0.05). Biostimulation via the addition of a commercially available fertilizer to soil slurries, resulted in a nearly 29% increase (t-test, p<0.05) in naphthalene mineralization for CCK soils, while mineralization in the TR soils was actually lower in fertilized microcosms (reduced by 38%, although not significant, p=0.06). Overall, these results suggest that prior exposure to PAH's influences a sites capacity to mineralize naphthalene. Biostimulation appears to enhance mineralization of at least naphthalene in CCK soils, if not other PAH's. Further work to determine if bioaugmentation, with bacterial pure cultures known to mineralize naphthalene, will also prove useful in the remediation of this PAH in CCK soils are underway.

- 92 VAN OS, LESLIE, AMANDA CHUDY, STACEY BRYSON, AND JUANITA LEONHARD. Illinois College—A comparison of the anti-microbial effect of essential oils against Bacteria and fungi of medical significance.

The anti-microbial effect of five essential oils derived from higher plants was investigated. Distillation-derived essential oil extracts from *Eucalyptus globulus*, *E. citriodora*, *Melaleuca alternifolia* (Myrtaceae), *Lavandula angustifolia*, and *Ocimum sanctum* (Lamiaceae) were tested against *Staphylococcus aureus*, *Escherichia coli*, *Serratia marcescens*, *Pseudomonas aeruginosa*, *Candida albicans*, *Trichophyton mentagrophytes*, and *Trichophyton rubrum* using the disk diffusion method. Preliminary data suggest that the anti-microbial effect of essential oils varies with the microbe tested.

- 93 KIRKER, G.T., S.V. DIEHL, AND M.L. PREWITT. Mississippi State University—Effects of Chlorothalonil (CTN) and Butylated Hydroxy Toluene (BHT) on microbial communities involved in deterioration of wood using T-RFLP.

The effects of Chlorothalonil (CTN) and Butylated Hydroxy Toluene (BHT) on microbial species diversity in wood and the surrounding soil are being assessed by Terminal Restriction Fragment Length Polymorphism (T-RFLP). CTN is a compound currently being evaluated as a wood preservative, and BHT is currently being evaluated for its synergistic effects with CTN. One year data will be presented from research that is currently underway. TRFLP data is being analyzed to determine significant differences in

patterns of microbial colonization over time due to wood preservative treatment in southern yellow pine (SYP) both above and below ground. Results show decreases in fungal and bacterial phylotype diversity for both the above and below ground portions of preservative treated SYP wood samples. Of particular interest is the absence of Basidiomycete fungi in the below ground sections treated with CTN+BHT when compared to untreated controls as well as differences in bacterial diversity at differing test sites. Characterization of these pattern shifts will provide a better understanding of the biology and ecology of wood decay microorganisms as well as the effects of biocides on the microbial community in treated wood and in the soil.

- 94 NAHAR, PRANJAL, KEVIN FLINN, AND CHRISTI MAGRATH. Troy University—A transcription termination profile of the autonomous replication sequences from Chromosome III of *Saccharomyces cerevisiae*.

The twenty autonomous replication sequences (ARSs) located on Chromosome III of *Saccharomyces cerevisiae* are located primarily in intergenic regions and the most active ARS elements are localized within 200 base pairs of the 3'-end of a gene. Introduction of the ARS elements into the transcription termination reporter cassette enables an assessment of the level of transcription termination using enzyme assays that indirectly measure the amount of non-terminated transcripts. The termination efficiency can be correlated with the orientation and replication efficiency of the replication sequence. Therefore, as a first step toward creating a transcription termination profile of the ARSs of Chromosome III, the termination capacity of the most replicatively active ARS elements are being assessed. The results allow the “molecular shield” hypothesis—transcription termination sequences found at the 3'-end of genes shield of replication initiation elements—to be explored.

- 95 WAGNER, DAVID¹ AND BRIAN SCHOLTENS². University of Connecticut¹ and College of Charleston²—Our journey through the Lepidoptera of Great Smoky Mountains National Park.

The Lepidoptera TWIG of the Great Smoky Mountains ATBI has recorded over 1600 species of moths and butterflies from GSMNP, and compiled over 21,000 individual specimen records in just over 5 years of survey work. We have used bioblitzes as foci to encourage greater involvement from the systematic community and bolster our species list – more than 30 lepidopterists have participated in aspects of the inventory. We estimate the total number of species in the park to be between 2000 and 2500, with mostly microlepidoptera (especially Gelechioidea) still to be added to the list. We have recorded more than two dozen undescribed species from the Park, including a spectacular Park endemic geometrid moth. Our surveys of the Park's lepidopteran fauna have included considerable life history work as well. In our last two bioblitzes we expanded our efforts to include DNA barcoding, with the goal of obtaining a sequence from all species known from the Park. The survey has resulted in several publications, with others nearing completion. Support for these efforts has come from Discover Life in America and a variety of other sources.

- 96 SANDERS, NATHAN¹, ROBERT DUNN², JEAN-PHILIPPE LESSARD¹, MELISSA GERAGHTY¹. University of Tennessee, Knoxville¹ and North Carolina State University²—Spatial diversity of forest ants in Great Smoky Mountains National Park, USA

Ants are ubiquitous in forests, especially in Great Smoky Mountains National Park (GSMNP), USA. However, much remains to be learned about the causes of spatial variation in ant species diversity. We sampled ants over several years in >30 sites to examine spatial patterns of ant diversity in GSMNP. In total, we have identified

approximately 100 ant species, many of which are new records to GSMNP, if not entirely new to science. Species accumulation curves show that at many of the most species rich sites, we are only beginning to adequately sample the ant fauna. We find that species diversity declines sharply with elevation because ants are strongly limited by temperature.

- 97 MAYOR, ADRIEAN. Great Smoky Mountains National Park—Native bees (Hymenoptera: Apoidea) of the GSMNP.

In one of only five bee inventories conducted east of the Mississippi, the USDA-ARS Bee Biology & Systematics Laboratory located in Logan, Utah recorded 144 species of bees found in Great Smoky Mountains National Park, and anticipated a Park bee fauna of over 250 species. Conducted in 2002, the inventory reported 16 new state records and one of the bees (*Andrena* sp. 2) may be a new species to science. Since this inventory an additional 56 species have been discovered, bringing the total to 200 bee species found in the Park.

- 98 LANGDON, KEITH. GSMNP—Dragonflies and Damselflies of the Smokies.

The odonate fauna of Great Smoky Mountains National Park (TN/NC) is being systematically studied and documented for the first time as part of the Smokies' All Species Biodiversity Inventory (ATBI). With orientation and direction from scientific authorities and park staff, a team of citizen volunteers have undertaken to survey significant aquatic systems in the Park. Specimens, catch and release records, and reliable sight records are used in the survey, which emphasizes adult collections. Recent field guides for both dragonflies and damselflies and close-focusing binoculars are used. Data are captured in the ATBI database for analysis of distributions, phenology, abundances, etc. and for eventually use with many other geographic themes being developed in the park. To date 92 taxa are reported from the park, but not all larger water bodies have been sampled and many that have, require multiple visits to effectively document each site's fauna. Several rare/unusual taxa are reported.

- 99 CLEBSCH, EDWARD E. C. AND JAMES D. COKENDOLPHER. Greenback, TN and Lubbock, TX—Pseudoscorpions of the Great Smoky Mountains—an introduction.

External morphological features of pseudoscorpions that are important in classification and useful in identification are briefly reviewed, as are a few aspects of feeding, life history, ecology, and behavior. The history of study of the group in the Smokies and in the region is reviewed, and the current state of our knowledge of the group in the region is evaluated.

- 100 WATTERS, G. THOMAS¹ AND DAN C. DOURSON². Ohio State University¹ and Stanton, KY²—Land snail surveys of the Great Smoky Mountains National Park.

The Great Smoky Mountains harbors one of the most diverse land snail assemblages in North America. At least 45 taxa are unique to the southern Appalachian Mountains, some occupying no more than a few counties. Although famous for its snails, the Great Smoky Mountains have never been systematically surveyed. The All Taxa Biodiversity Inventory and several independent projects have allowed the authors and their staff to begin a comprehensive survey of the Park. Now in its sixth year, over 300 sites have been examined, largely using leaf litter samples. The inventory now includes over 140 taxa, many of which are new records for the Park, including several species perhaps new to science. The use of GIS technology has allowed us to map the distribution of each species and relate it to various habitat characteristics.

- 101 PETERSEN, MATTHEW J. AND JESSICA D. DAVIS, Iowa State University–
Influence of abiotic factors on a southern Appalachian crane fly (Diptera; Tipuloidea) fauna.

The degree to which taxa create assemblages across a spectrum of habitats is dependant on numerous environmental factors including habitat heterogeneity and type, climate, elevation, and disturbance history. For species rich insect groups such as crane flies (Diptera: Tipuloidea) these forces will act on both the larval and adult life stages, each separately working to determine species distributions. The adult crane flies of a southern Appalachian montane ecosystem were inventoried from October 2000-2001 to determine the extent to which they formed distinct assemblages between forest types and to identify abiotic factors influencing their distributions. Sampling locales showed moderate levels of beta diversity between closed canopy forest types as apposed to high levels of beta diversity between closed and open canopy types. Minimum and maximum temperatures, plot aspect, and canopy cover were significant predictors of fly community assemblage. Surprisingly, elevation was not a significant factor affecting fly community composition. The grouping of forest types with closed canopy indicates a heterogeneous crane fly fauna that is less affected by forest type than by degree of canopy insolation.

- 102 NELSON, DIANE R.¹ AND PAUL J. BARTELS². East Tennessee State University¹ and Warren Wilson College²–Smoky Bears: Tardigrada of the Great Smoky Mountains National Park.

As part of the All Taxa Biodiversity Inventory (ATBI) in the Great Smoky Mountains National Park (GSMNP), we have collected a total of 592 samples from soil/decomposed leaf litter, lichens and mosses on trees, and stream sediment and periphyton within all 19 permanent ATBI plots. About 75% of these samples have been processed. We have collected some additional samples from caves, rock lichens, seeps, and bird nests. Recently we began taking new samples from deep soils and high elevation anakeesta rock formations. Tardigrades have been extracted from samples using centrifugation with Ludox AM™ and mounted on individual microscope slides in Hoyer's medium for identification under phase and DIC microscopy. Prior to our study, only three species of tardigrades had been previously reported from a few samples in the park. We have now examined over 7000 slides and recorded 69 species, 13 of which we believe may be new to science. We have also calculated species richness estimates using EstimateS 6 software for each of the major tardigrade habitats and for comparison of the number of tardigrade species in mosses on trees at breast height and at the base. We are developing a key to the species of tardigrades in the GSMNP, including photographs of the species and illustrations of all the characters and character states. This key will be available on the Internet.

- 103 CASH, W.B.¹, JAY CLARK², FRANK van MANEN², JESSICA DANIEL³, JON DAVENPORT⁴, JOSHUA ENNEN⁵, JAMES RAMSEY³ AND JAMES WEBB¹. Maryville College¹, University of Tennessee², Murray State University³, East Carolina University⁴ and University of Southern Mississippi⁵–Reptile richness of Great Smoky Mountains National Park.

From 2000 to 2004, 1356 reptile individuals representing 33 species were encountered in Great Smoky Mountains National Park. Reptiles were sampled at 70 permanent sites and multiple random localities throughout the 2200 sq. km park. Various techniques were employed to encounter reptiles including visual search and seizure, temporary drift fences with screen mesh funnel traps, metal roofing tin arrays, turtle hoop trapping, spotting scopes, and collection of reptiles found dead on road surfaces. Multiple biotic and abiotic variables were measured at each point of encounter, including UTM coordinates, elevation, date and general life history notes (sex, life stage, and general morphological

characteristics). Overall reptile species richness of Great Smoky Mountains National Park was increased to 38 species from the 36 confirmed historic records when the project began. The two new species were the slider turtle (*Trachemys scripta*) and the common musk turtle (*Sternotherus odoratus*). The three most commonly encountered reptile species were the Eastern garter snake (*Thamnophis sirtalis*), black racer (*Coluber constrictor*) and the copperhead (*Agkistrodon contortrix*). Conversely, the three least commonly encountered species were the mole kingsnake (*Lampropeltis calligaster*), the Southeastern five-lined skink (*Eumeces inexpectatus*) and the Eastern hognose snake (*Heterodon platyrhinos*). Five species known historically from the park were not encountered during the inventory (coal skink, *Eumeces anthracinus*; scarlet snake, *Cemophora coccinea*; pine snake, *Pituophis melanoleucus*; Southeastern crowned snake, *Tantilla coronata*; Eastern slender glass lizard, *Ophisaurus attenuatus*). We will discuss our data in the context of conservation management of reptiles in the park and provide probability of distribution models for selected species.

- 104 SIMONS, THEODORE, R.¹ AND SUSAN A. SHRINER². USGS Cooperative Research Unit, North Carolina State University¹ and Colorado State University²—Breeding bird inventories in Great Smoky Mountains National Park - links to research and monitoring.

Forest songbirds provide a model system for studying and monitoring biological diversity. They comprise a diverse group with a wide range of ecological requirements that are easily interpreted to the general public. For these reasons we conducted an extensive inventory of breeding birds in Great Smoky Mountains National Park between 1996 and 1999. For all years combined we established 4,159 independent plots throughout the Park, and conducted a total of 7,573 point count censuses, recording 74,797 individuals of 115 species. We will illustrate how inventory data for birds has been incorporated into the Park's long term inventory and monitoring program, and how these data have been applied to: model species distributions and habitat associations across the Park, to estimate the importance of the Park as a regional population source for declining bird species, to predict the degree to which site disturbances due to development or management may affect particular breeding bird species, and to project the effects of large-scale changes in forest composition caused by exotic pests, diseases, and air pollution.

- 105 PIVORUN, EDWARD B. Clemson University—Small mammal population dynamics within the ATBI sites of the GSMNP.

This study was initiated in October 1999 and over 2500 small rodents and insectivores had been trapped up to December 2004. Seventeen ATBI sites and 48 additional sites were sampled with Sherman live traps and pitfalls. Mark recapture techniques were used to assess population parameters. *Peromyscus maniculatus*, the deer mouse, is the dominant small rodent throughout the park. However, *Clethrionomys gapperi*, the red-backed vole, occasionally displayed dominance at altitudes above 4000 ft. *Sorex cinereus*, the masked shrew, is the dominant insectivore at higher altitudes and *Blarina brevicauda*, the short-tailed shrew dominates at lower altitudes. Rodent populations associated with specific ecosystems in the park display dynamic shifts in species composition and biomass. These population changes can occur on a seasonal basis or over a span of years. Highest "species diversity" is associated with some of the harshest environments at altitudes above 4000 ft. One example of the dynamic aspects of mammal population composition was noted at the Clingmans Dome ATBI site. In 1999 the red-backed vole was dominant in the fall trapping period. This was noted again in 2000, 2001 and 2002. However, in the spring and summer trapping periods of 2000-2002 the populations of voles and deer mice displayed comparable densities. The rock vole displayed relatively high densities in 1999-2000, but virtually disappeared in 2001-2002. At Indian Gap voles

and deer mice displayed comparable population sizes during 2000 and 2001. In 2002 the mice surpassed the vole populations.

- 106 LANDOLT, JOHN C.¹ AND STEVEN L. STEPHENSON². Shepherd University¹ and University of Arkansas²—Mycetozoans of the Great Smoky Mountains National Park.

During the period of 1998 to 2005, surveys for dictyostelids (cellular slime molds) and myxomycetes (plasmodial slime molds or myxogastrids) were carried out at numerous study sites throughout the Great Smoky Mountains National Park as one component of the All Taxa Biodiversity Inventory (ATBI) project. These study sites included examples of all major forest types along with the more common types of non-forest vegetation. Since the surveys began, the number of dictyostelids known from the Park has increased from 12 to at least 30, whereas the number of myxomycetes has increased from 88 to more than 220. The new records of dictyostelids from the Park include 10 species new to science. Many of these are "small" species that seem to be confined to marginal habitats at higher elevations. A number of species of myxomycetes appear to be restricted largely or exclusively to the red spruce-Fraser fir forests found at the very highest elevations in the Park. Some of these, including such examples as *Barbeyella minutissima*, *Elaeomyxa cerifera* and *Lepidoderma tigrinum*, tend to be associated with the substrate complex represented by the decaying wood of decorticated spruce logs with a cover of leafy liverworts (particularly *Nowellia curvifolia*) present.

- 107 REMBERT, DAVID H.¹, PALMER E. KRANTZ², AND JOHN B. NELSON¹. University of South Carolina¹ and Riverbanks Zoo and Garden²—The vegetation and natural history of Bomb Island, South Carolina.

Located just west of Columbia, Lake Murray is one of South Carolina's largest and deepest freshwater artificial bodies of water. It was completed in 1930, and now covers about 50,000 acres. Elsewhere in the state, it is exceeded in area only by Lakes Marion and Moultrie (shorelines entirely within South Carolina). Lake Murray's development effectively inundated a considerable portion of the lower drainage of the Saluda River, whose headwaters are in North Carolina. High-ground "hilltop" islands characterize the lake, these scattered widely, and varying dramatically in size. Bomb Island is located in Lexington County, roughly in the center of the lake. This island comprises about twelve acres, representing an early-growth piedmont forest system, its ecology now dramatically altered by the lake's development, early military use of the site as a target for bombing practice, and nearly constant and mid-level disturbance in the form of public recreation, and the presence of a small population (6) of goats. Despite its past disturbance, the island retains an interesting and surprisingly diverse vascular flora, as well as providing the largest roosting site of purple martins (*Progne subis*) in North America. Hilltop islands offer opportunities for study of both relictual populations and biological immigration dynamics.

- 108 DARR, ANN R.¹, ALBERT B. PITTMAN² AND KATHY A. BOYLE². A.C. Moore Herbarium, University of South Carolina¹ and South Carolina Heritage Trust Program²—Botanical Survey of Marl, Limestone, and Chert Formations in South Carolina.

A botanical survey of significant plant communities and vascular plant species of state and federal concern was conducted in the middle and outer coastal plains of South Carolina in areas underlain by marl, limestone, and chert. Geomorphologic features such as river bluffs, limestone sinks, sink ponds, caves, and springs were targeted for inventory. Examples of these features and exposures consist of Cretaceous and Tertiary age strata over Santee Limestone and Cooper Marl formations, respectively. In addition, Holocene Age shell mounds and rings left by Native Americans along the state's coastal zone were

surveyed. Since most of soils in South Carolina are very acidic in reaction, those only slightly acidic to neutral and high in calcium are relatively rare with many of the dominant communities and plant species found to be uncommon as well. Over fifty sites were surveyed and twenty-seven species of state and federal concern were identified. Six hundred and fifty species representing 111 families were collected and curated at the A.C. Moore Herbarium of the University of South Carolina.

- 109 BRADBURY, E. JANE¹, JOHN B. NELSON¹, AND ANN DARR². University of South Carolina¹ and South Carolina Department of Natural Resources²—Vascular plant inventory of Congaree Bluffs Heritage Preserve.

The Congaree Bluffs Heritage Preserve comprises over 200 acres on the west side of the Congaree River in Calhoun County, South Carolina, the river separating this site from the extensive floodplain ecosystem of the Congaree National Park. Steep north- and northeast-facing bluffs reaching 60m above the river are an anomalous part of the landscape here, but are nevertheless characteristic of major Southeastern river systems. These bluffs feature a diverse vascular flora including a number of taxa more commonly found in the Piedmont and mountains. The rolling topography that dominates the site has been highly altered after years of human habitation and agriculture. This high ground is traditionally accepted as a part of the state's historical longleaf-pine-dominated midlands, although *Pinus palustris* is no longer present at the site. In order to understand how burning has affected the ecosystem on Congaree Bluffs, an inventory of vascular plant life was conducted following a controlled burn in April, 2003, along with a seed bank and soil sample analysis.

- 110 BARRON, JENNIFER, AMANDA BRIANT, BRITTNEY DENIER CANTRELL, GINA CHILDERS, MICHELLE CLIFTON, SARAH GOWDER, RENEE VAN CLEAVE, AND MICHAEL WAYNE MORRIS. North Georgia College & State University—A floristic study of Ramblewood, Lumpkin County, Georgia.

A survey of the vascular plants of Ramblewood, Lumpkin County, Georgia, was conducted from August 2004 through July 2005. The study site is a privately owned tract of land (approximately 88 ha) used for annual Dahlonega Wildflower Festival field trips. Ramblewood is in the Upper Chattahoochee River Watershed and on the border of the Piedmont and Blue Ridge physiographic regions. Plant communities range from upland oak-hickory-pine forest to mesophytic forest on ravine slopes and bluffs to riparian zone vegetation along Yahoola Creek. Specimens of vascular plants were processed using standard herbarium techniques. Field surveys resulted in the documentation of 91 families, 259 genera, and 393 species. Of these taxa, there were 35 invasive species representing 8.9% of the flora at the site. Rare and unusual species or taxa of special concern tracked by the Georgia Department of Natural Resources include *Cypripedium parviflorum* var. *pubescens*, *Hexastylis shuttleworthii*, *Menispermum canadense*, *Panax quinquefolius*, and *Spiranthes ovalis*.

- 111 NELSON, JOHN B. University of South Carolina—The Jepson Manual, and the hedge-nettles (*Stachys*, Lamiaceae) of California.

Considerable and perennial attention has been devoted to the botany of California, and with good reason. California has an exceedingly rich vascular flora, containing nearly 6,000 vascular plant species, of which nearly a quarter are endemic. California's dramatic and dynamic geology is in large part responsible for its great landscape diversity. To the end of understanding and conserving the rich floristic heritage of California, the Jepson Manual Project has emerged. Willis Jepson authored his *Manual of the Flowering Plants of California* in 1925, and this was followed by an incomplete and multi-volume *Flora of California*. The Jepson Manual Project was based on a revolutionary premise: a single

work of this magnitude can be simultaneously accessible to dedicated beginners and indispensable to professional botanists. *The Jepson Manual—Higher Plants of California* was published, edited by James Hickman, in 1993. The upcoming second edition of the manual will include 12 species of *Stachys* (Lamiaceae), 7 of which are endemic. The genus is widely distributed throughout the regions of the California Floristic and Desert Provinces, less so in the Great Basin Province. Of considerable interest are species-rich areas of concentration, especially within the North and South Coast Ranges, inland into the Great Central Valley. Such localized concentrations of species are unusual for the genus in North America.

- 112 JOHNSON, GEORGE. P. Arkansas Tech University—The Orchidaceae in Arkansas.

A specimen-based study of the Orchidaceae for the Vascular Flora of Arkansas Project has generated a checklist of 40 taxa that are known to occur or that have occurred within the State. These taxa comprise 18 genera, 36 species, 3 infraspecific taxa, and one naturally-occurring hybrid, and represent 4.6% of the monocots and 1.4% of the total number of taxa known for the State, respectively. *Spiranthes* and *Platanthera* are the largest genera of orchids, with 10 and 8 taxa, respectively; 12 genera are represented by a single species. While *Spiranthes* is one of the most easily recognized genera, its taxa are the most difficult to identify. Particularly difficult is the *Spiranthes cernua* complex, composed of *Spiranthes odorata* and *Spiranthes cernua*, a facultatively agamospermic polyploid compilospecies. Of the 40 taxa of orchids known for the state, 19, or 47.5%, are currently listed as Plants of Special Concern by the Arkansas Natural Heritage Commission. Included within the checklist is *Platanthera nivea*, the snowy orchid, now extirpated from the State. *Platanthera nivea* grew in the Grand Prairie region of eastern Arkansas and was last seen and collected in 1883. Excluded from the checklist are 7 taxa that have been attributed to but which do not occur in the State. Inclusion of these taxa was based on misidentifications and/or collections that were made outside of present day Arkansas. All specimens examined, over 1300 to date, as well as those mentioned in the literature, have been databased.

- 113 GENTRY, JOHNNIE L.¹, GEORGE P. JOHNSON², SARAH C. NUNN¹, ERIC SUNDELL³, AND C. THEO WITSELL⁴. University of Arkansas¹, Arkansas Tech University², University of Arkansas at Monticello³, and Arkansas Natural Heritage Commission⁴—The Arkansas Vascular Flora Project: The Flora, the Royal Rubi, and on Golden Pond.

The Arkansas Vascular Flora Project was initiated in 1999 as a cooperative endeavor among 17 botanists within and outside of the State. To date, the Committee has published a Checklist of the state's vascular flora that totals 2893 taxa, comprising 191 families, 925 genera, 2703 species, 167 infraspecific taxa, and 23 hybrids; 623 taxa, or 21.5%, are non-native to the United States. These numbers represent an increase of approximately 375 taxa over the previous effort to document the state's flora, now nearly fifteen years old. Assembling the Checklist has involved a critical examination of approximately 200,000 herbarium specimens located in herbaria within and outside the State (many not examined in previous efforts), intensive collecting in poorly collected parts of the State, and searches of literature and online databases. In addition to revising the Checklist, future efforts will be centered on the production of an Atlas of the distribution of the state's flora, constructing a database of the specimens deposited within the state's herbaria, and publishing a Manual to aid in the identification of all vascular plants known to occur within the State. An evaluation of the genus *Rubus* resulted in the recognition of sixteen (16) species in the flora. The application of the names *Rubus ostryifolius* and *R. pensylvanicus* as well as the Ozark endemic *R. mollior* will be discussed. A recent field trip to an impoundment built on the edge of a bay head seep in the West Gulf Coastal Plain

discovered a botanical hot spot yielding eleven (11) State records and ten (10) rare plants in a one hectare area. Notable collections were (state records) *Utricularia striata*, *Ludwigia brevipes*, and *Fuirena breviseta* and (rare plants) *Leersia hexandra*, *Ludwigia microcarpa*, and *Websteria confervoides*.

- 114 ESTES, DWAYNE. University of Tennessee—The vascular flora of Giles County, Tennessee.

A survey of the vascular flora of Giles County, Tennessee was conducted between July 1998 and September 2004. A total of 1208 species and infraspecific taxa, representing 138 families and 553 genera, were documented from 30 qualitatively defined habitats, resulting in 912 county records. Several rare taxa were discovered, including two federally threatened species: *Aplos priceana* and *Helianthus eggertii*. Other noteworthy rare species found were *Cimicifuga rubifolia*, *Perideridia americana*, *Stellaria fontinalis*, and *Xyris laxifolia* var. *iridifolia*. *Arenaria lanuginosa*, a Tennessee endangered species thought extirpated from the state, was rediscovered after not having been collected since 1948. In addition, three state records, *Achyranthes japonica*, *Euonymus kiautschovicus*, and *Eupatorium × pinnatifidum*, were found. Other noteworthy collections included *Baccharis halimifolia* and *Amaranthus powelli*, each representing second reports from Tennessee.

- 115 ESTES, DWAYNE. University of Tennessee—A new narrowly endemic species of Clematis (Ranunculaceae; subgenus Viorna) from northeastern Texas.

A previously unrecognized species of *Clematis* subgenus *Viorna*, here referred to as the Carrizo sands leather-flower, has recently been discovered and is currently being described as new to science. This species is endemic to the Carrizo sands geologic formation and is known only from a few sites in three contiguous counties in northeastern Texas. The Carrizo sands leather-flower belongs to the *Clematis glaucophylla* species complex, a group characterized by glaucous and glabrous abaxial leaf surfaces and stems. Four additional species comprise this complex: *C. addisonii*, *C. glaucophylla*, *C. texensis*, and *C. versicolor*. The taxonomic history of this group is presented along with a comparison of the morphology, distribution, and ecology of the members of the complex.

- 116 POINDEXTER, DERICK B., ZACK E. MURRELL, AND GARY L. WALKER. Appalachian State University—The preliminary vascular flora of Mount Jefferson State Natural Area and environs.

Mount Jefferson State Natural Area is a 243 ha (601 acres) site located in central Ashe County, NC within the Southern Section of the Blue Ridge Province. This mountain reaches a peak elevation of 1427 m and towers over the small towns of Jefferson and West Jefferson. Geologically, Mount Jefferson is dominated by the metamorphic parent material amphibolite. This substrate releases magnesium, calcium, aluminum, and iron cations into the above soil layers upon weathering, thus helping to ameliorate or neutralize soil pH. In theory, this increase in soil pH creates a more hospitable environment for vegetative growth and species establishment. This high pH is unusual in the Blue Ridge Mountains with amphibolite outcrops restricted to Northwestern South Carolina and Northwestern North Carolina. Only a select few of these mountains in North Carolina have received floristic attention. Those that have been comprehensively inventoried include Bluff Mountain and Phoenix Mountain. Both of these peaks lie adjacent to Mount Jefferson and have demonstrated substantial floristic diversity. This study will provide comparative floristic data to better our understanding of the biogeography of the Southern Appalachians by helping to tease apart one constituent of an ecoregion that has been traditionally viewed as a uniform entity. Mount Jefferson was already known to provide habitat for multiple state listed species such as *Woodsia ilvensis* and *Prenanthes*

roanensis, as well as one federally listed species, *Saxifraga caroliniana*. Our survey documented approximately 600 species in 92 families, including several previously undocumented taxa that are significantly rare within the state.

- 117 McMULLEN, CONLEY K. AND ANDREA WEEKS. James Madison University and George Mason University—A taxonomic revision of the endemic members of *Cordia* (Boraginaceae) in the Galápagos Islands – preliminary results.

Seven species of *Cordia* L. (Boraginaceae) are thought to inhabit the Galápagos Islands. As currently understood, four of these species are endemic (*C. anderssonii*, *C. leucophlyctis*, *C. revoluta*, *C. scouleri*), two are probably native (*C. lutea*, *C. polyccephala*), and one is introduced (*C. alliodora*). The endemics and natives are thought to have originated in the western (Andean) region of South America, and arrived in the archipelago via long-distance dispersal by birds. In habit, Galápagos members range from low-growing shrubs to small trees, and occupy both arid lowlands and moist uplands. Difficulties arise when dealing with this genus in the archipelago because three of the four endemics are not readily distinguishable using available keys and descriptions. The study reported here is making use of a variety of characters (morphological, molecular, palynological, and reproductive) to determine the relationships between these endemic species. Results will be used to prepare a much-needed taxonomic revision of these endemics. An added benefit of this study is that it will provide Galápagos conservation officials with updated nomenclature for the genus, a clear understanding of species limits and relationships, and reliable records of species distributions.

- 118 JONES, RONALD L. Eastern Kentucky University—Additions and corrections for the first printing of *Plant Life of Kentucky*, and an updated checklist of the vascular flora.

Since the publication of *Plant Life of Kentucky* in March 2005, 15 new state records have been published, along with accounts that clarify the status of nine other taxa. Ten of the 15 state records were treated in the text (as “to be expected” or because the existence of the voucher was known prior to publication), but five were not mentioned at all. Among the anticipated state records are the annual saltmarsh aster, *Symphyotrichum divaricatum*, a native of the southeastern U.S., and purple moonflower, *Ipomoea turbinata*, an exotic species from India. Of the five new additions, four are exotic and one, smooth sawgrass (*Cladium mariscoides*), is a native of the eastern U.S. Corrections for the first printing of the text include additions to the Acknowledgments, changes in Tables 4 and 10, several spelling corrections, realignment of the couplets in Keys O and P, and corrections for the abbreviations indicating rare or exotic status. The taxa listed in *Plant Life of Kentucky*, along with the new additions and changes, have now been compiled into an *Updated Checklist of the Vascular Flora of Kentucky*, listing a total 2,656 taxa. Full scientific names along with standardized author citations are given for all taxa, along with common names. The taxa in the list are placed in four categories—1) native but not state-listed; 2) native and state-listed; 3) non-native with established self-perpetuating populations; 4) non-native but not likely to produce established self-perpetuating populations; and 5) species credited to Kentucky in the recent literature.

- 119 JONES, RONALD L. Eastern Kentucky University—A history of floristic botany in Kentucky.

Kentucky floristics began with the travels, observations, and collections of A. Michaux and his son F.A. Michaux from 1793–1802. In the early 19th century C.S. Rafinesque and C.W. Short (and associates) collected extensively in Kentucky and published significant works. Around 1900 S.F. Price was very active, and left many significant collections and publications. In the first half of the 20th century H. Garman and F. McFarland presided

over growing herbaria at the University of Kentucky, and two pioneering women botanists, E. Braun and M. Wharton, also made major floristic contributions. In 1948 fire destroyed the UK Herbarium, but it has been gradually rebuilt by curators D. Smith, E. Browne, and W. Meijer, now housing about 55,000 specimens. At the University of Louisville floristic activities were led by P.A. Davies in the 1950s and 1960s, and continued under later curators and students, the collection now numbering about 35,000 specimens. Herbaria at regional herbaria and colleges have greatly expanded since the 1970s, and now house about 200,000 specimens. State agencies and private citizens have also contributed greatly to our knowledge of the flora. Curators/professors in Kentucky, led by J. Thieret over the last 30 years, have worked with extraordinary effort to document the disappearing flora of Kentucky through the building of collections and the publication of articles and books. Many of these herbaria now face precarious futures as these curators near retirement and their departments shift their focus from field biology to molecular biology.

- 120 MELLICHAMP, T. LAWRENCE. University of North Carolina at Charlotte—A history of pictures of pitchers (*Sarracenia*).

By examining the numerous published illustrations of endemic North American pitcher plants in the genus *Sarracenia* (Sarraceniaceae) over the past 430 years, we can learn a great deal about their mysterious discovery, early impressions of their unusual structure, initial attempts at scientific understanding, and primitive efforts at cultivation. The first drawing dates from 1576, with better renditions in the later centuries. There are myths that surround the explanations for the purpose or function of the unusual hollow leaves that were so often the subject of the early naturalists artistic talents. It wasn't until 1876 that they were proven to be carnivorous. Perhaps more so than other North American flowering plants, *Sarracenia* species can be recognized by their distinctive leaves; not even their flowers always allow correct identification. Early 19th century attempts at cultivation resulted in less than accurate representations of the species. Other illustrations show evidence of hybridization. Of the 10-12 known species, all are inter-fertile with wild hybrids and backcrosses possible whenever 2 or more species grow together. Modern pictures show an array of beautiful species forms and complex hybrids that have inspired people all over the world.

- 121 MURPHY, STACI M.¹, MICHAEL J. YABSLEY¹, M. PAGE LUTTRELL¹, DAVID E. STALLKNECHT¹, AND SUSAN E. LITTLE². Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia¹ and Department of Pathobiology, College of Veterinary Medicine, Center for Veterinary Health Sciences, Oklahoma State University²—Experimental inoculation of raccoons (*Procyon lotor*) with *Anaplasma phagocytophilum*, *Ehrlichia chaffeensis*, *Ehrlichia canis*, *Ehrlichia ewingii*, and *Borrelia lonestari*.

Previous studies found serologic and/or molecular evidence for infection of raccoons with several tick-borne pathogens of human and veterinary importance. In the current study, we investigated the experimental susceptibility of raccoons for five of these emerging tick-borne pathogens. Each inoculation trial consisted of three raccoons; two were each inoculated with either *E. chaffeensis*-infected DH82 cells, *E. canis*-infected DH82 cells, *E. ewingii*-positive dog blood, *Anaplasma phagocytophilum*-infected tick cells, or *B. lonestari* spirochetes, and one negative control raccoon was inoculated with either uninfected dog blood or cell cultures. Infections were assessed by a combination of polymerase chain reaction (PCR), indirect fluorescent antibody testing, and/or cell culture isolation methods every 3-6 days for at least 30 days post-inoculation (DPI). Both *A. phagocytophilum*-inoculated raccoons were PCR positive by 3 and 12 DPI and seroconverted ($\geq 1:64$) on 24 and 30 DPI, respectively. Both raccoons remained PCR and IFA positive until 74 DPI. One *E. chaffeensis*-inoculated raccoon was PCR-positive from 9 to 27 DPI, culture positive on

9 DPI, and seropositive from 12 to 48 DPI. None of the *E. ewingii*- or *E. canis*-inoculated raccoons seroconverted and only one raccoon was PCR positive for *E. canis* on 3 DPI. The *B. lonestari*-inoculated raccoons were PCR negative throughout the study, but seroconversion was evident in one raccoon from 3 until 30 DPI. These data suggest that raccoons are not important reservoirs of *E. canis*, *E. ewingii*, or *B. lonestari*; however, they may be involved in the natural maintenance of two important zoonoses, *A. phagocytophilum* and *E. chaffeensis*.

- 122 ESLICK, RENÉ M. and VINCENT A. CONNORS. University of South Carolina Upstate—Production of the reactive oxygen species, superoxide, by cells from the *Biomphalaria glabrata* (Pulmonata) embryonic cell line.

Previous work in our laboratory has shown that cells from the immortalized *Biomphalaria glabrata* embryonic (Bge) cell line exhibit increased motility and phagocytosis of target particles following stimulation with the cytokine, interleukin-1 (IL-1). These responses were similar to those reported for hemocytes from normally schistosome-susceptible *B. glabrata* following injection of IL-1, which has been shown to result in increased hemocyte phagocytic activity, hemocyte superoxide production, and parasite killing in the snail. The purpose the work reported herein was to determine if phagocytic stimulation of Bge cells also resulted in the production of superoxide in these cells. To determine if superoxide was produced in Bge cells a modified in vitro phagocytosis assay was developed. In short, cells cultured in 8-well chamber slides were exposed to treatments containing phagocytosis targets (Zymosan) in the presence or absence of both the superoxide indicator, nitro-blue-tetrazolium (NBT), and the superoxide scavenger, superoxide dismutase (SOD). Results show that SOD drastically inhibits the reduction of NBT to formazan, confirming that Bge cells are capable of producing superoxide. These results further suggest that Bge cells may be useful as a potential *in vitro* model for the analysis of hemocyte mediated killing mechanisms in the snail. This work was supported by a Teaching and Productive Scholarship grant from the Teaching Enhancement Committee of USC Upstate.

- 123 MINTER, JENNIFER AND EDWIN ROWLAND. Ohio University—Fate of intracellular *Trypanosoma cruzi* inhibited from egressing the host cell.

The protozoan parasite *Trypanosoma cruzi* is the causative agent of Chagas disease. The chronic stage of infection is characterized by a production of neutralizing antibodies in the vertebrate host. A polyclonal antibody, anti-egressin, has been found in our lab to inhibit egress of parasites from the host cell late in the intracellular cycle, after the parasites have transformed from the replicative amastigote into the trypomastigote. It was also found in our lab that cells in the late stages of parasite infection become permeable to molecules as large as antibodies, leading to the possibility that anti-egressin affects the intracellular parasites. This project addresses the fate of the intracellular trypomastigotes that have been inhibited from egressing the host cell. Extracellular *T. cruzi* trypomastigotes have been found to agglutinate in the presence of anti-egressin containing chronic mouse serum. The possible agglutination effect on intracellular parasites will have been determined by artificially releasing the parasites from the host cell. Also, anti-egressin treated infected cells were transferred to an uninfected culture, which resulted in a decrease of extracellular trypomastigotes relative to the control after the secondary infection period. Further evidence of the infectivity of these parasites will have been obtained by artificially releasing the trypomastigotes from the anti-egressin-treated host cells and measuring their infectivity on fresh host cells *in vitro*. These measures will help to elucidate the fate of the parasite in the anti-egressin treated cultures and will provide insight to the effectiveness of the antibody to hinder progression of the infection.

- 124 HARTMAN, ANGELA¹, ROBERT C. WILLIAMS¹, ALEXA C. ROSYPAL² AND DAVID S. LINDSAY¹. Virginia Tech¹ and University of North Carolina Chapel Hill²—Efficacy of the FTA-filter based method to detect DNA of *Cryptosporidium parvum* and *Toxoplasma gondii* from oocysts

Researchers have developed a method to detect protozoa such as *Cyclospora cayetanensis*, *Cryptosporidium parvum*, *Enterocytozoon bieneusi*, and *Encephalitozoon intestinalis* using a filter-based protocol. FTA filters have been proposed as a useful method to replace traditional time-consuming DNA extraction methods for detecting parasites from food, environmental, water, and stool samples. This study was performed to determine if FTA filters could be used to extract DNA from oocysts of *C. parvum* and *T. gondii*. Extractions were performed on *C. parvum* oocysts, *T. gondii* oocysts, *T. gondii* tachyzoites, and on *T. gondii* oocysts treated with bleach to break down oocyst walls. Each sample of 1×10^5 oocysts or tachyzoites/ml was applied to FTA filters and prepared as DNA templates using modified methods of Orlandi and Lampel, 2000. The parasite sample spotted test filters were each used directly as template DNA for PCR. An 18SrRNA primer set was used to detect *C. parvum* and an ITS1 primer set was used to detect *T. gondii*. *Cryptosporidium parvum* oocysts were readily detected. For *T. gondii*, DNA was detected from 1×10^5 *T. gondii* tachyzoites, while no DNA was detected with 1×10^5 sporulated *T. gondii* oocysts or 1×10^5 sporulated *T. gondii* oocysts treated with bleach. An additional amplification was conducted using PCR product from oocyst samples as template DNA and *T. gondii* was still not detected. This study suggests that FTA filter-based extraction may be useful in detection of *C. parvum* while other methods need to be developed for *T. gondii*. Supported in part by a BRIDGE grant to DSL.

- 125 MITCHELL, SHEILA M., ANNE M. ZAJAC, AND DAVID S. LINDSAY. Virginia Tech—Development of *Cystoisospora canis* in cell culture: Evidence for unizoic cyst formation in vitro.

Endogenous stages of *Cystoisospora* species develop in the small intestine of their definitive host but extraintestinal stages can also occur in the mesenteric lymph nodes (MLN) and other tissues of both definitive and paratenic hosts. Little is known about the biology of these stages. Few attempts have been made to grow *Cystoisospora canis* in cell culture. Cover slips with bovine turbinate (BT) cell or African green monkey kidney cell (CV-1) monolayers were infected with 1×10^5 excysted *C. canis* sporozoites. Cover slips were removed on various days, fixed, and stained for light microscopy. Sporozoites invaded both cell types. A clear parasitophorous vacuole was present around most sporozoites viewed on days 2 and 10 post infection for both cell types. On days 15 and 16 post infection, cyst wall developed surrounding the sporozoites in BT and CV-1 cells, respectively, appearing to fill in the parasitophorous vacuoles. These stages structurally resemble the unizoic cysts seen in the MLN of paratenic hosts. No division of sporozoites was observed at any observation period. There was no difference in sporozoite lengths and widths in BT and CV-1 cells from 2 – 17 day PI, respectively. In both cell types there were slight differences in cyst wall dimensions from days 2 – 17. Viability of the zoites within cysts is currently being assessed. Transmission electron microscopy is also currently being done to further characterize these stages. Supported in part by a BRIDGE grant to DSL.

- 126 CASSELL, MEREDITH¹, JEANNINE S. STROBL², CHRIS REILLY², AND DAVID S. LINDSAY¹. Virginia Tech¹ and Virginia College of Osteopathic Medicine²—Efficacy of histone deacetylase inhibitors against *Toxoplasma gondii*

Toxoplasma gondii is a well-recognized cause of disease in congenitally infected infants and immunocompromised individuals. Histone deacetylase (HdAC) is a regulatory enzyme that is necessary for chromatin structure and gene expression. One study indicated that

the histone deacetylase inhibitor (HDI), apicidin, had activity against *T. gondii* in vitro. The present study was done to determine if the HDI suberoylanilide hydroxamic acid (SAHA) and trichostatin A (TSA) had activity against the RH strain of *T. gondii*. TSA and SAHA inhibit class I and class II HdACs defined by their homology to yeast HdACs, Rpd3 and Hda1, respectively. Activity of these 2 agents was evaluated using tachyzoite counting and monolayer protection assays. Briefly, 48-well plates containing HS68 cells were infected with *T. gondii* tachyzoites and allowed to incubate for 1 hour. The media containing all non-infective parasites were then removed. Medium containing the various concentrations of SAHA or TSA or vehicle only was placed in the infected wells. On day 5 of the incubation period the numbers of tachyzoites present in the media were determined by counting in a hemocytometer. The EC₅₀ of SAHA was 30 nM and that of TSA was 108 nM. The cell monolayers were stained with crystal violet and examined for lesions (plaques). SAHA and TSA showed complete protection of monolayers at 100 nM and 200 nM concentrations, respectively. Nicotinamide, an inhibitor of NAD⁺-dependent class III HdACs, had no activity against *T. gondii* in our assays. HDI have potential as new treatments for toxoplasmosis. Supported by a grant from the Carilion Biomedical Institute.

- 127 GAJI, RAJSHEKHAR Y. AND DANIEL K. HOWE. Department of Veterinary Science, University OF Kentucky, Lexington, KY—GAGACGC is a critical cis-acting element required for SnSAG1 gene expression in *Sarcocystis neurona*.

Sarcocystis neurona is an obligatory intracellular parasite in the phylum Apicomplexa, and is the major cause of equine protozoal myeloencephalitis (EPM) in horses. Intracellular development of the parasite is accomplished by a complex process known as endopolygeny during which there is temporal regulation of gene expression. With the objective of characterizing regulatory elements, gene loci were isolated from a *S. neurona* genomic library and the 5' and 3' flanking regions were sequenced. Examination of 5' flanking regions of SnSAG1, SnSAG2, SnSAG3, SnNTP and Sarco-21 genes did not reveal standard eukaryotic promoter elements. However, a 7-base conserved motif, GCGTCTC, was identified by comparative analysis. This motif is present in either orientation, and there may be single or multiple copies upstream of the transcription start sites. This motif is similar to the WGAGACG/CGTCTCW sequence that has been shown to play a role in gene transcription in *Toxoplasma gondii*. To test the activity of potential regulatory sequences, we have implemented a dual luciferase assay for *S. neurona* gene expression using firefly and renilla luciferase reporter genes. The results showed that inclusion of both 5' and 3' flanking regions is required for efficient transcription of the reporter molecule. Furthermore, functional analysis of 5' flanking region of SnSAG1 using a series of deletion mutants indicated that the GAGACGC motif, located 129 bases upstream of the major transcription start site, is critical for transcription. These studies aimed at characterizing *S. neurona* promoters may provide insight into the mechanisms that control gene expression during parasite development.

- 128 STIEVE, ERICA¹, KIMBERLEE BECKMEN², AND SHARON PATTON.¹ University of Tennessee College of Veterinary Medicine¹ and Alaska Department of Fish and Game²—Seroprevalence of *Neospora* spp. and *Toxoplasma gondii* in caribou, moose, wolf, and fox populations in Alaska.

Neospora caninum is a protozoan parasite recently distinguished from *Toxoplasma gondii* (Bjerkås et al., 1984) and named by Dubey et al. (1988). It causes abortions in cattle and neurological problems in dogs. McAllister et al. (1998) determined the dog as the definitive host and additional published data have since included the coyote as a definitive host in a sylvan life cycle of the protozoan. This project measured the seroprevalence of *Neospora caninum* in wildlife populations in Alaska including animals that may serve as definite or intermediate hosts. We analyzed serum samples from caribou (n=205), moose (n=201), and wolf (n=200) collected during the 1998-2004 field seasons. We evaluated each

sample for antibodies to both *Neospora* (IFA) and *Toxoplasma* (MAT) because of the antigenic similarities between the two parasites and the potential for cross reactivity. The seroprevalence follows: caribou (10.7% seropositive for *Neospora*; 0.5% seropositive for *T. gondii*), moose (0.5% / 0%), wolf (6.0%/ 7.5%). There may be species or environmental differences that alter the seroprevalence in the caribou, moose, and wolf populations that share the same geographical area.

- 129 STONE, SHARON¹, VINA DIDERRICH-FAULKNER², PAUL E. SUPER³ AND, CHARLES T. FAULKNER¹. University of Tennessee College of Veterinary Medicine, Knoxville, TN¹, Lincoln Memorial University, Harrogate, TN², and Great Smoky Mountains National Park, Lake Junaluska, NC³—Endoparasitic Infections in Migratory Birds from the 2003-2005 Banding Seasons at the Purchase Knob, Great Smoky Mountains National Park, Lake Junaluska, NC.

During the summers of 2003, 2004, and 2005, fecal samples (n=265) representing 40 species of passerine birds were examined for parasitic infection in conjunction with the All Taxa Biodiversity Inventory (ATBI) and the Monitoring Avian Productivity and Survivorship (MAPS) projects conducted in the Great Smoky Mountains National Park. Evidence of parasitic infection was detected in 47 samples examined. Coccidia oocysts possibly *Isospora* sp. or *Atoxoplasma* sp. were present in 25 samples, Trichostrongyle-type eggs probably from *Trichostrongylus tenuis* were found in 5 samples, *Syngamus* eggs were found in 13 samples, *Capillaria* sp. eggs were found in 13 samples, Spiruid-type eggs were found in 1 sample, and tapeworm eggs were found in 6 samples. Five birds had mixed infections. The occurrence of the coccida oocysts in 12 different passerine species is of interest because this group of parasites has only been previously reported in the wild from the Eastern blue bird, *Sialia sialis*, and a song sparrow, *Melospiza melodia*. Continuing research in this population of migratory passerine birds is directed at the understanding the relationship of parasitic infection with host variables (foraging habitat, diet, and migratory behavior) and geographic variables (vegetation cover and elevation) in the Great Smoky Mountains National Park.

- 130 DIDERRICH-FAULKNER, VINA¹, LEAH ALLEN¹, CHARLES T. FAULKNER², AND PAUL E. SUPER³. Lincoln Memorial University, Harrogate TN¹, and University of Tennessee College of Veterinary Medicine, Knoxville TN², and Great Smoky Mountains National Park, Lake Junaluska, NC³—Patterns of positivity: Endoparasitic infection and host behaviors and in migratory birds from the 2005 banding seasons at the Purchase Knob, Great Smoky Mountains National Park, Lake Junaluska, NC.

The high elevation (>5000 feet) of the Great Smoky Mountains National Park is a unique environment for studying ecologic relationships between avian hosts and factors influential for parasite transmission. The effects of foraging habitat, diet, and migratory behavior on patterns of parasitic infection are poorly understood. Birds identified as ground or canopy foragers were analyzed according to their foraging habitat and its potential impact on parasite infection status. Subsequently birds were classified as insect-eaters or seed/fruit/berry eaters, and neotropical migrants or resident/short distance migrants for analyses of diet and migratory behavior on parasitic infection. In each of these comparisons there was no statistical association (chi-square, p >0.05) between foraging habitat, diet and migratory behavior and parasitic infection. Despite these results, insect-eating birds exhibit a tendency to harbor parasitic infections (p=0.07). However, our results may be confounded by the observation that many species of birds inhabiting the high elevation zone of the Great Smoky Mountains are dietary generalists during the juvenile stages in their life cycle and traditionally defined seed-eaters also consume insects prior to adulthood. We also recognize that the breeding season for birds in 2005

was delayed by a late snowfall May, and the age structure of captured birds included fewer juveniles samples compared to the previous 2 banding seasons.

- 131 BEASLEY, RODNEY, DARREL SCHMITZ, CHARLES WAX, AND BURNETT HAMIL. Mississippi State University—I will be fearless as a teacher: a peer teaching exercise using Rachel Carson's book Silent Spring.

Learn how to increase teamwork, self-esteem, and environmental knowledge in the science classroom by using one of the influential books that helped spark the environmental movement in the U.S. and abroad. The activities in the peer teaching exercise include the following on an assigned chapter out of the Silent Spring: a detailed power point presentation, a reflective collage, and an objective test. As a part of a high school environmental science/geology curriculum, the peer teaching exercise was designed toward a multidisciplinary approach based upon the National Science Standards for Earth Science and Biology. Peer teaching is a student mediated instructional procedure in which student dyads or small learning groups work together on learning task. When supervised correctly, peer teaching can help teachers multitask the many objectives for a variety of academic courses. In addition to helping organize objectives, peer teaching allows the teacher to select for a broad spectrum of cognitive domain (Blooms Taxonomy) for better evaluation instruments such as rubrics and checklist. While students are engaged in a peer teaching activity, there is increased interaction among the students and teacher. Many educational research studies have reported increased self-esteem among high school students that participate in peer teaching exercises. As a teacher, it is difficult to try new methodologies in the classroom, but as times change, teachers must have the courage to explore new ways of teaching.

- 132 EZELL, WM. BRUCE. University of North Carolina at Pembroke—Using Stories in the Teaching of Non-Major Biology Classes

Interesting and surprising stories can be used to interest non-major students in biology, and generate questions about various biological phenomena. In this paper, those in attendance shall receive an example of a story that has been used to stimulate classroom discussion. The story is entitled Chance Encounter. This whimsical narrative is a detailed description of a human encounter with a host-seeking female mosquito. Woven into the story are details of female mosquito feeding behavior and its etiology, the use of human blood (as a protein source), mating behavior, the need for both sexes to obtain a carbohydrate food source, and the relationship between saltmarsh mosquito population cycles and lunar influences. The idea behind the story telling is to stimulate students to question the details of the story, and then propose hypotheses as to why something, which might sound initially preposterous, might be true.

- 133 HELD, MICHAEL E. Saint Peter's College—Case studies, scientific literacy and the non-major science course

Most colleges require non-science students to take a course(s) in one of the traditional sciences to fulfill a general education requirement. These courses may mix majors and non-majors into a single course or there may be a separate section of a major level course. At some institutions non-science students select courses specifically designed for them and not available to majors in those fields. These courses may or may not include a laboratory component. While most scientists agree that exposure to science is an essential component of a college education, there has been debate on the form and content of these courses. Courses run the gamut from being a slightly less rigorous form of the major's course to those that include fewer concepts that require in-depth learning. For many years I have struggled to reach a balance of concept coverage in my introductory science course. I have moved from a fairly intensive coverage to the less is

more view of teaching these courses. I have discovered that most non-science students are both interested in and fearful of science at the same time. They show more interest if the course is built around a few major concepts presented in ways that are related to their present and past experiences. This past year I have had success using case studies (<http://ublib.buffalo.edu/libraries/projects/cases/case.html>) to illustrate the concepts under discussion in lecture. The topics included: the scientific process, ethics in science, genetics, evolution, and biotechnology. Successes, failures and conclusions from this course will be discussed.

- 134 ALIFF, JOHN VINCENT. Georgia Perimeter College, Gwinnett University Center—Dealing with student perceptions of the nature of science.

From a reading of popular literature and student surveys, the most common misunderstandings of science are as follows: 1.) To believe the explanations of science requires faith, 2.) Theories are educated guesses of explanations, 3.) Science is an ideology or a religion; 4.) It is unfair for science to exclude supernatural explanations; 4.) Science is only concerned with absolute facts; 5. Science and scientists are hostile to other explanations of nature; 6.) Teaching the randomness of mutation and evolution, usually mistakenly equated with "Darwinism," is equivalent to teaching atheism; 7.) Many believe that for anything to be true, it must be scientifically correct (e.g., scriptural or Koranic inerrancy). The late Carl Sagan warned of a "combustible mixture of power and ignorance" that threatened science. In teaching biology we should not ignore these issues, but deal with them directly by emphasizing the methodology and value of science. This and other (Massimo Pigliucci) authors strongly recommend that science not be invoked as in support of religion or in opposition to it. Scientism is an extension of philosophic naturalism that asserts that all explanations are to be found in nature. Such an assertion may be correct or not, but regardless, many students, scientists, and the general public need a respectful comfort zone for their spirituality. Contrasting the methods of knowledge and objectives of science with religion, allows truth to speak, rather than ideology.

- 135 EZELL, WM. BRUCE. University of North Carolina at Pembroke—Evolution in Public Education: the Role of the Professional Biologist ... Splendid Isolation or Creative Engagement?

The struggle over evolution and various forms of creationism (including intelligent design) continues unabated in the classrooms of public education systems across the nation. What are the role(s), if any, for the professional biologist, when consulted by school board members, parents, teachers, and concerned citizens? If we expect science to grow and continue to flourish, biologists must be willing to enter the public arena and participate in public education policy formation. The teaching of concepts like "intelligent design" in the same classroom beside traditional Neo-Darwinism appears to most folk to be rooted in American democratic notions like "freedom of speech" and "the hearing of all points of view." However, these concepts do not apply to the teaching of creationism in the classroom, because it is not science. Teaching intelligent design in the science classroom is like trying to force a discussion on sociology in a class concerned with the Calculus! Biologists participating in the public debate on this issue should be aware of how they may be perceived. A good starting point of common ground is the "search for truth," while admitting that techniques and approaches may be different. Science being primarily concerned with the "how" of certain phenomena, while religion considers the "why." Thus science and religion might be considered alternative approaches to reality, not necessarily mutually exclusive, but using different language approaches and symbols to their realms of study ("nature" for science and "God" for theology). The biologist in public meetings should distinguish between "discovery science" (which the public understands) and "hypothesis-driven science" (which is more common today and not generally understood

by the lay public). A second distinction must be made between chemical evolution, microevolution, and macroevolution. The lay public is less threatened by microevolution. Some comment about "truth" is usually helpful. Most scientists believe that science approaches truth via statistical inference. The lay public generally has no concept of how or why statistics are necessary and vital in modern research. The methods of religion are obviously different, utilizing different criteria. It is important to set reasonable limits on what is to be discussed. The biologist need not wander into fields like quantum physics, although the opposition might like this. Like an expert witness in a trial, the biologist in public must stay within his/her discipline and not be dragged into discussions of cosmology.

- 136 HERTZ, PAUL E. Barnard College, New York, USA—Reaching the 21st Century Student.

Over the past century, biological research has generated new factual information, conceptual insights, and practical applications at an explosive rate. Interdisciplinary studies into the complexities of life are breaking down the artificial boundaries that separated once-distinct areas of Biology. This rapid pace of discovery makes Biology the most intriguing of all the natural sciences, but also problematic for instructors. How can Biology instructors - as well as Biology students - absorb the rapidly increasing volume of ideas and information? New editions of existing textbooks often just tack on new ideas and discoveries. As a result, students have difficulty navigating the wealth of information and they lose track of the big picture while instructors are left to fill in the pieces. Paul Hertz's vision has been to foster understanding by presenting the basic facts and principles of Biology in the light of biological knowledge today. This forthcoming text will present historical research and give students insight into the unanswered questions researchers are working on today and how those discoveries could impact the world. Students will learn about the modern molecular tools that allow scientists to ask and answer questions not thought of just 20 years ago. Clarity of presentation, a high level of organization, and a seamless flow of topics within chapters are central to the approach. Emerging from this style is an experimental theme that teaches students, through example, how to ask scientific questions and pose hypotheses.

- 137 HENDRIXSON, BRENT E. AND JASON E. BOND. East Carolina University—Molecular phylogeny of the spider genera *Antrodiaetus* and *Atypoides* (Araneae: Mygalomorphae:Antrodiaetidae).

The genera *Antrodiaetus* and *Atypoides* belong to the basal mygalomorph lineage Atypoidina. These spiders build silk-lined subterranean burrows whose entrances are concealed by a collapsible collar or turret. This group has a Holarctic distribution with regions of endemism in the Pacific Northwest, the Desert Southwest, the eastern USA, and Japan. A morphology-based phylogeny has been proposed in the literature; however, this hypothesis was largely built upon the use of continuous quantitative characters (a character type that is highly contentious in systematics), so a need to re-evaluate that phylogeny using independently derived information is desirable. We collected molecular data from mitochondrial and nuclear genes (cytochrome c oxidase subunit I, 18S rRNA, 28S rRNA; ~3500 bp) to test previous hypotheses of species-level relationships in *Antrodiaetus* and *Atypoides*. In addition, we sought to: (1) evaluate genealogical exclusivity and status of nominal species; (2) determine the nomenclatural status of *Atypoides* (monophyletic versus paraphyletic); and (3) refine the biogeographical history of this spider lineage by using Bayesian methods and penalized likelihood (with nonparametric rate smoothing). Our results support portions of the previous hypothesis (e.g., status of the *Antrodiaetus lincolnianus* clade, placement of *An. roretzi* at the base of *Antrodiaetus*, non-sister relationship between the Japanese species, paraphyly of

Atypoides), but provide several new testable hypothesized relationships and consequently, a new biogeographical scenario.

- 138 DAFOE, ROBERT AND FRANK A. ROMANO. Jacksonville State University—Preliminary results of a leaf litter tardigrade survey on Dauphin Island, Alabama.

Dauphin Island is a barrier island in the Gulf of Mexico just south of Mobile Bay, AL. Four transects (east to west) across the island, from Bay to Gulf, were established through the eastern forested areas of the island to survey tardigrade communities. Within each transect samples of mosses/lichens growing on trees and leaf litter (upper & lower separated) were sampled from Oct. 1999 through Dec. 2000. Transect 1 is the eastern most transect, through the Audubon forest, and 2 trees (live oak and tupelo) were sampled. Transect 2 extended through Cadillac Square and 8 trees (6 live oak & 2 tupelo) were sampled. Transect 3, just west of Rt. 193 and crossed through the Isle du Dauphine golf course, had 5 trees (live oak) sampled. Transect 4, just east of the Dauphin Island elementary school, sampled 3 trees (magnolia, pine, & live oak). Moss/lichen samples contained very few tardigrades but the upper leaf litter contained a greater number. S. Mattingly (former JSU student) found approximately 1100 tardigrades that were extracted and mounted from these samples. Most (84.5 %) tardigrades were in the genus *Macrobiotus*. Others genera found were *Hypsibius*, *Milnesium*, and *Calcarobiotus*. R. Dafoe, is finishing this study and is examining the lower leaf litter. All extracted tardigrades will be identified to species and a comparison between upper and lower leaf litter will be attempted.

- 139 DIMOCK, RONALD V., JR. Wake Forest University – Siphons on demand: not all bivalve molluscs have fused-mantle plumbing to separate inhalant and exhalant flow.

Most bivalve molluscs employ sheet-like gills for respiration and suspension feeding. Ciliary powered current flows dorsally through the gills and exits the posterior-dorsal mantle cavity. Water enters via the ventral gape or more commonly through a posterior aperture, the inhalant siphon. To avoid recycling, inhalant and exhalant flows must be separated. In the simplest arrangement siphons created by apposition of the lateral mantle skirts serve this purpose. The most elaborate plumbing involves complete fusion of the posterior mantle margins, forming two separate ducts which approach a meter in length in deep-burrowing species. Three families of freshwater mussels (Unionoida) separate inhalant and exhalant water by very different combinations of gill and siphonal architecture. In the Unionidae the posterior of the gill demibranchs is fused with the mantle margins, creating the exhalant siphon; a second more ventral mantle fusion completes the inhalant siphon. In the Hyriidae, the demibranchs are attached to a horizontal, perforate branchial membrane separating inhalant and exhalant flow. In the Margaritiferidae the posterior of the conjoined demibranchs is a highly motile unit with lateral, blood-inflated wing-like structures that fit into diaphragmatic septa (grooved pallial ridges) of each posterior mantle skirt, creating complete but temporary separation of inhalant and exhalant water. The kinetics of this interlocking of gills and mantle will be shown via video imaging of *Cumberlandia monodonta*. The only other extant bivalve with similar pallial ridges is the Australian marine genus *Neotrigonia*, the only living remnant of the Trigoniidae, thought to be the ancestors of freshwater mussels.

- 140 NIX, E. ASHBY¹, MICHAEL K. MOORE^{1,2}, VICTOR W. TOWNSEND³, JR., BART KIMBRELL², AND BLAKE KIMBRELL² ¹Department of Environmental Science and ²Biology, Mercer University, Macon, GA 31207, ³Department of Biology, Virginia Wesleyan College, Norfolk, VA—Animal diversity and community structure in phytotelmata of *Heliconia aurea* from Trinidad, W. I.

Phytotelmata, aquatic habitats held within various plant parts, have recently emerged as model systems in testing hypotheses in the field of community ecology. Recent studies have demonstrated the usefulness of these systems in the characterization of animal community structure and in making diversity comparisons between regions. Aquatic communities contained in 154 bracts of *Heliconia aurea* were collected from tropical evergreen forest near Petite Tacaribe, Trinidad, and analyzed for community biodiversity. 9,132 total individuals were collected. Acarids were the most abundant, comprising 63.5% of the sample. Other dominant organisms included nematodes (16.1%) and dipteran larvae (16.0%). We found comparatively low overall diversity (Shannon Index = 1.96) in these samples when compared to other epiphyte communities from the Caribbean and South America. Analysis of variance showed there were no statistically significant differences observed between the measured diversity ($p = 0.89$) or the number of individuals in bracts ($p = 0.58$) from individual *Heliconia*. However, significant differences were observed in # of individuals and trophic structure when comparing bracts of different age. Overall community structure is similar to other described allochthonous phytotelmata communities.

- 141 PHILLIPS, ANNA J. AND ROBERT WAYNE VAN DEVENDER. Appalachian State University—Preliminary survey of the leeches of Cat Tien National Park, Dong Nai Province, Vietnam

Relatively little is known about the diversity, ecology or behavior of leeches in most parts of the world, especially Southeast Asia. Nevertheless, leeches are abundant invertebrates in the Vietnamese ecosystems. Due to the lack of information about Southeast Asian leeches, collecting in this region can contribute greatly to our understanding of this important group. Therefore, a preliminary survey of leeches was carried out between June 1 and June 10, 2005 in the southern portion of Cat Tien National Park in Dong Nai Province, Vietnam. Leeches were collected from human subjects in several terrestrial and aquatic sites including most habitats in the area. All amphibians and reptiles encountered were also searched for leeches. Sixty-two leeches were collected and preserved in 90% ethanol for later analysis. These seemed to represent three species in two families. Variation within each type of leech was examined to determine range of morphological variation within each species and to identify the actual species present. All terrestrial leeches seemed to be one species in the Family Haemidipsidae; but aquatic leeches probably represent two species of the Family Hirudinidae. Distribution, variation and field observations on each of these species will be presented.

- 142 PHILLIPS, ANNA J.¹ AND MARK E. SIDDALL². Appalachian State University¹ and American Museum of Natural History²—Phylogeny of the New World medicinal leech family Macrobdellidae (Oligochaeta: Hirudinida: Arhynchobdellida).

Phylogenetic analyses of the leech family Macrobdellidae were accomplished with all nominal species from the family save one. A total of 17 specimens in the nine ingroup species were analyzed, along with four outgroup taxa. Twenty-two morphological characters based on jaw dentition, sexual anatomy, and external morphology failed to provide a resolution for many of the relationships in the family. DNA sequence data from nuclear 18s rDNA, nuclear 28s rDNA, mitochondrial 12s rDNA, and mitochondrial cytochrome c oxidase subunit I were examined separately and in combination with morphological characters. The resulting combined analysis strongly corroborated the placement of the genus *Philobdella* within the family Macrobdellidae and as sister to a monophyletic genus *Macrobdella*, the typical North American medicinal leeches. Furthermore, sequence divergences among these taxa confirmed the existence of two species, *Philobdella gracilis* and *Philobdella floridana*, which are readily distinguishable on the basis of jaw dentition.

- 143 PROUD, DANIEL N.¹, VICTOR R. TOWNSEND, JR¹, AND MICHAEL K. MOORE². Virginia Wesleyan College¹ and Mercer University²—Use of logs, palm fronds, and bromeliads by arachnids in montane rainforests of Trinidad, W. I.

In comparison to rainforests at lower elevations, montane rainforests feature a lower canopy and a more diverse assortment of lianas and bromeliads. In Trinidad, this habitat only occurs at the higher elevations in a few locations in the Northern Range. The ecology and natural history of most species of invertebrates living in these rainforests remains to be studied. In this investigation, we examined the use of logs, the sheaths of palm fronds, and bromeliads by arachnids in montane rainforest along Morne Bleu Ridge. From 20 July to 5 August 2005, we sampled 30 logs, 30 palm fronds, and 23 bromeliads and captured 1 species of amblypygid (*Phrynus pulchripes*), 4 species of scorpions, and 10 species of harvestmen. The most common taxa were cosmetids, cranaids, and manaosbiids. We found significantly more harvestmen in the sheaths of palm fronds than under logs or in bromeliads. For *P. pulchripes*, we captured relatively few individuals from either logs and in the sheaths of palm fronds. For scorpions, we collected specimens of *Tityus trinitatus*, *T. melanostictus*, *Broteochactus nitidus*, and an unidentified chactid. Scorpions were collected in both bromeliads and the sheaths of palm fronds, but none were found in or beneath logs.

- 144 AL-ZEIN, MOHAMMAD S.¹ and KHOZAMA M. KNIO². Old Dominion University¹ and American University of Beirut²—Comparative life history and behavioral studies of two cryptic and sympatric *Chaetostomella* species (Diptera: Tephritidae)

Chaetostomella cylindrica (Robineau-Desvoidy) and *C. lurida* (Loew) are cryptic and sympatric non-frugivorous fruit flies that cannot be differentiated morphologically. Ecologically, the two taxa differ: While *C. cylindrica* is highly oligophagous, *C. lurida* is monophagous. The two taxa also differ morphometrically and can be separated with more than 70% accuracy using canonical discriminant analysis. *Chaetostomella lurida* has been poorly described and its taxonomic status is not clear. This study re-describes all the stages of *C. lurida* and aims at separating the two closely related taxa behaviorally. The morphology of the immature stages of the two taxa was similar, except that the size of all studied stages was larger in *C. lurida*. The adult behavior of the two taxa, mainly oviposition behavior and mating behavior, turned out to be very similar, except for slight differences in post-copulatory and oviposition behaviors. Comparative genetic and cross-mating studies need to be performed before the taxonomic status of *C. lurida* can be resolved.

- 145 MAREK, PAUL E. AND JASON E. BOND. East Carolina University—Systematics and color mimicry evolution of cyanide-producing millipedes of Appalachia (Polydesmida, Xystodesmidae, Apheloriini)

The millipede genus *Brachoria* occurs in moist, deciduous forests from southeastern Indiana to eastern Kentucky, southward to northern Alabama and eastern Louisiana, with high levels of endemic species diversity in the eastern Cumberland Plateau. *Brachoria* is one of twelve genera in the Appalachian millipede tribe, Apheloriini, and was the focus of a systematic revision. Because apheloriine classification was (1) unstable and contentious, (2) based largely on genitalic morphology, and (3) suffered from lack of explicit phylogenetic reasoning, we chose to perform an exemplar approach phylogenetic reconstruction of the tribe to clarify generic boundaries with a focus on the phylogenetic placement of nominal *Brachoria* species. This project encompasses a phylogeny-based classification system of Apheloriini, with an emphasis on the monophyly of *Brachoria* species and thereby provides a framework to subsequently revise monophyletic groups,

describe new species, and as a backdrop to addressing interesting evolutionary questions like the occurrence of widespread color mimicry in *Brachoria*.

- 146 ODOM, C. BRIAN . Wingate University-. A novel method for the collection of non-alate ants from colonies of the Red Imported Fire Ant, Solenopsis invicta (Buren).

The entomological literature presents numerous methods for collecting ants. Collection methods seem to fall into two main categories; those that collect one or a few ants at a time with very little "clean up" of the specimens required, or those methods that collect large numbers of ants at one time, but then extensive labor is required to isolate the ants for preservation. We have developed a method for quickly (less than one minute) collecting 100-300 ants from a mound with virtually no additional time being needed to clean and isolate the specimens.

- 147 BROWN, CHRISTOPHER G. AND DANIEL J. FUNK. Vanderbilt University–Fecal-case associated behavior and life history of *Neochlamisus* leaf beetles.

Leaf beetle taxa belonging to the Camptosomata group use their fecal material to construct cases within which their larvae develop. Despite this intriguing behavior, the fine-scale natural history of very few camptosomates has been determined. Here, we present a highly detailed account of fecal case construction and associated behaviors and life history patterns in *Neochlamisus* case-bearers. Using an independently derived method, we also document temporal and spatial aspects of larval case architecture. Assays of 10 *Neochlamisus* taxa in the laboratory are supplemented with field observations to provide a detailed description of case-associated camptosomite biology.

- 148 GARRIS, HEATH W. AND JOHN A. SNYDER Furman University–Sex-specific attraction of Southeastern United States moth populations to ultraviolet light.

The mechanism and strength of phototoxic behavior by nocturnal flying insects to UV light (350-400 nm) varies among species. It has been proposed that UV light trap collections of moths show consistent male-dominated sex biases. In this study, sex ratios of 56 moth species were observed; 26 of these species were analyzed for significant biases. Fifteen species demonstrated a statistically significant male dominated sex bias, but a range of responses from male to female dominance was found. Offsets toward a single sex were species-specific and there was no apparent consistency within taxa. This variability among species may result from a combination of factors including sex ratios upon eclosion, variable energetic expenditures, flight periods and durations, relative activity, and behavioral factors. Sex-specific flight periods were evaluated for species whose percentage of males varied over the observation period. Two Noctuid species, *Thioptera nigrofimbria* and *Tetanolita mynesalis*, demonstrated a significant change-over from male to female dominated trap catches over the observation period. These results were the reverse of eclosion observations where females tend to emerge first, suggesting the presence of distinct, sex-specific flight periods with some overlap. Further investigations are required to provide more data on these and other species, and to determine the relative influence of factors contributing to sex bias in attraction of moths to UV light. Understanding these relative sex ratios may improve population estimation techniques and provide information for conservation or control of individual moth species.

- 149 STOCKMAN, AMY K. AND JASON E. BOND. East Carolina University–Extreme population structuring on a micro-geographic scale in Californian trapdoor spiders.

The trapdoor spider genus *Promyrmekiaphila* belongs to the spider Infraorder Mygalomorphae (trapdoor spiders, tarantulas and their kin). The three nominal species of

Promyrmekiaphila, like many mygalomorphs, are known solely from brief and antiquated morphological descriptions. Furthermore, two species were described from female specimens only, rendering the descriptions problematic due to the lack of distinguishing morphological features typical of female mygalomorphs. We have reconstructed the phylogeny of *Promyrmekiaphila* using molecular characters. One thousand base pairs from the 16S rRNA and cytochrome oxidase I (COI) genes of the mitochondrion were amplified, sequenced, and aligned. For phylogenetic inference we employed a Bayesian approach, dividing the sequence data into four partitions: three partitions representing the three codon positions of the COI gene and a separate partition for the 16S data. Our analysis shows extreme levels of genetic divergence across all populations sampled on a very fine geographical scale. We use the phylogeny, distributional pattern, and ecological correlates as a framework to delineate 11 cryptic species.

- 150 GRAHAM, JAMES R., GARY WALKER, RAY WILLIAMS, ZACK MURRELL, AND ART REX. Appalachian State University—*Tsuga canadensis* ecosystems and spatial patterns of *Adelges tsugae* infestation in northwestern North Carolina.

Hemlock ecosystems and associated plant assemblages are at risk of decline in the southern Appalachians. Grandfather Mountain, Linville, Lutherock and northern Watauga County in North Carolina harbor exceptional examples of these ecosystems. If not suppressed, *Adelges tsugae*, the hemlock woolly adelgid (HWA), may facilitate the destruction of native hemlocks throughout the region. Hemlock woolly adelgid has infested over one-half of the eastern hemlock's range within the United States. The goals of this project are: 1) identify biotic and abiotic interrelationships by analyzing baseline data, 2) develop a methodology for permanently monitoring hemlock ecosystems in the region, and 3) assist the surrounding communities in employing an effective system for conserving biodiversity in hemlock ecosystems using Geographic Information Systems (GIS). Study sites are located in 20 hemlock stands in 5 localities selected to maximize combinations of age, elevation, slope, and aspect. Vegetation analyses were conducted at these sites using the North Carolina Vegetation Survey methodology, with the addition of arthropod inventories and age-class analysis. Analysis of vegetation data indicated that hemlock abundance was correlated with location and elevation. The results also indicated that there were no correlations between HWA infestation levels and measured environmental variables. Because most hemlock forests are infested with HWA, results from this study can be used as a reference by researchers, land managers, and conservationists to prioritize southern Appalachian hemlock forests for conservation and/or restoration.

- 151 JOHNSON, SARAH. E.¹ AND CLAUDIA L. JOLLS². ¹University of Wisconsin-Madison, ²East Carolina University, North Carolina—An assessment of the role of competition on the beach as a factor in the distribution of *Amaranthus pumilus* Raf. (Amaranthaceae).

Rare plants often are found in unproductive, stressful and highly disturbed habitats. It is thought that species that live in such habitats persist by avoiding competition through colonization of a more suitable habitat or microsite that is neither spatially nor temporally limited by other species. *Amaranthus pumilus* (seabeach amaranth) is a rare dune annual that establishes in the highly dynamic foredune habitat of the U.S. Atlantic Coast and is described as a fugitive species that is associated with habitat free of possible competitors. We assessed the potential for competition with associates using a point-centered quarter sampling regime and determined that the annual *Cakile edentula*, along with the perennials *Iva imbricata* and *Uniola panicualta*, were among the most frequent near associates of *A. pumilus* at Cape Lookout and Cape Hatteras National Seashores. Results from a growth room competition experiment indicated that *A. pumilus* growth is negatively affected by neighbors. Interspecific interactions were stronger and occurred sooner than

did effects by intraspecific neighbors. These data suggest that the upper limit of seabeach amaranth distribution on the beach may be influenced by competition; resource managers should take information such as this into consideration prior to making future management decisions.

- 152 KUTOSKY, WILLIAM¹, KRIS McDONALD¹, SARAH POULTER^{1,2}, AND LAWRENCE ZETTLER¹. Orchid Recovery Program, Illinois College¹ and Southern Illinois University²—Conservation-driven seed propagation and reintroduction of *Epidendrum nocturnum* (Orchidaceae) with a mycorrhizal fungus.

Seeds of an endangered epiphytic orchid from Florida (*Epidendrum nocturnum* Jacquin) germinated *in vitro* with a mycorrhizal fungus [*Epulorhiza repens* (Bernard) Moore, UAMH 9824] with the use of a technique normally applied to terrestrial orchids (symbiotic seed germination). Seeds from two sources (Fakahatchee Strand, Florida Panther NWR) were sown on either modified oats medium (MOM) or standard oat agar, and inoculated with the fungus. Significant differences in germination were detected between the two seed sources, and media had a significant effect on mean leaf length during incubation *in vitro*. After 48 days *in vitro*, all leaf-bearing seedlings were exposed to light, then transferred to a greenhouse *ex vitro* on sterilized *Sphagnum* moss with or without half-strength Miracle-Gro commercial fertilizer. After 163 days *ex vitro*, seedlings transferred to *Sphagnum* without Miracle-Gro displayed the highest survivorship (>90%), whereas Miracle Gro-exposed seedlings from standard oat agar experienced unusually high mortality (56%). Healthy seedlings with a mycotrophic capability were obtained one year after sowing and were subsequently re-introduced in Florida. This study has added merit in that some existing orchids within the Florida Panther NWR were recently lost to Hurricane Wilma. The symbiotic technique may, therefore, serve a useful purpose for conservation programs aimed at recovering epiphytic orchids threatened with extinction.

- 153 STRAHL, MAYA, MARTIN CIPOLLINI, RICHARD WARE AND PATRICIA TOMLINSON. Berry College—Vegetation survey of Martha's Meadow, a calcareous limestone glade habitat.

Martha's Meadow is a small area in northwestern Georgia on the Berry College campus dominated by a relatively open canopy and an herbaceous plant layer composed mainly of herbs and grasses. A prior informal survey of the vegetation on the site indicated a calcareous limestone glade or prairie habitat. Calcareous limestone habitats occur throughout the southeastern United States, have dry, calcium-rich soils that select against high woody species cover, and tend to be high in grass and herbaceous plant biodiversity. This project focused on conducting a vegetation survey of Martha's Meadow to determine the species composition and cover values of the vegetation to determine what kind of limestone habitat Martha's Meadow most closely resembles. It was found that the tree stratum of the site was dominated by Eastern red cedar (*Juniperus virginiana*), loblolly pine (*Pinus taeda*), Shumard oak (*Quercus shumardii*), and hophornbeam (*Ostrya virginiana*). The herbaceous stratum was composed of a wide variety of herbs and grasses, including (*Danthonia spicata*), wingstem (*Verbesina alternifolia*), Cherokee sedge (*Carex cherokeensis*), and Nepal or Japanese grass (*Microstegium vimineum*), with these dominating by only a small margin. The vegetation survey results suggest that Martha's is a type of subclimax limestone glade community, most likely a cedar barrens or xeric limestone prairie habitat.

- 154 WANG, WEI¹, SCOTT B. FRANKLIN¹ and JOHN R. OUELLETTE². University of Memphis¹ and Memphis Zoo²—Characteristics of a flowering event of an arrow bamboo *Fargesia qinlingensis*.

Sporadic flowering of *Fargesia qinlingensis* started in the late 1990's in a watershed at the Taibaishan National Natural Reserve, Shaanxi Province, China. The watershed area displayed mast flowering by the early 2000's. Three sites with un-flowered patches were selected and characteristics of flowering sites and un-flowered patches were studied over a three-year period (i.e. 2003, 2004, and 2005). Density of live culms decreased over the three years in both flowering sites and un-flowered patches, but more dramatically in flowering sites. New shoots, giant panda's preferred forage, regenerated only in un-flowered patches. Basal diameter and height of culms displayed no significant differences between flowering sites and un-flowered patches. Seedling density was significantly higher in flowering sites than in un-flowered patches, and was higher in 2004 than in 2005. Seedlings performed better in flowering sites than in un-flowered patches based on their height, leaf number per seedling, and average leaf length. Chemical compound allocation varied among culm parts, with leaves containing higher crude protein, hemi-cellulose, and crude fat, and lower organic matter, hemicellulose, cellulose, lignin, and crude fiber compared to branches and stems. Crude protein and crude fat in branches and leaves were lower in flowering culms than in un-flowered culms. Aboveground biomass of culms in un-flowered patches was three orders of magnitude higher than that of seedlings in flowering sites. This study suggested that the characteristics of bamboos and bamboo stands were dramatically altered during this flowering event.

- 155 BATTAGLIA, LORETTA L.¹ AND WILLIAM J. PLATT². Southern Illinois University Carbondale¹ and Louisiana State University²—Disassembly and reassembly of coastal plant communities: the role of abiotic and biotic filters in invasion resistance to seaward and landward migrations.

Rapid sea level rise is affecting coastal ecosystems along low-lying coastlines around the world. The ability of coastal species to migrate and thereby escape local extinction should depend upon their ability to overcome barriers to dispersal and establishment in new locations further inland. Seaward migration is effectively constrained by unalterable abiotic stresses (salinity and flooding), while landward migration is impeded largely by more malleable biotic stresses (e.g., recruitment limitation, competition for space or light). Natural disturbances that alter biotic stresses, disassembling communities on the landward side of coastal transitions, potentially could initiate inland migration of species on the seaward side of these transitions. Rather than a "conveyor belt" model of migration, we suggest that migration of coastal species may experience starts and stops coincident with disturbances that effectively reduce biological inertia and subsequent recovery of *in situ* vegetation that may close the migration window of opportunity. We propose a generalized conceptual model of vegetation response to sea level rise that incorporates natural disturbances as catalysts for coastal species migration.

- 156 COOK, REBECCA A.¹ AND PATRICIA D. PARR². Lambuth University¹ and Oak Ridge National Laboratory²—Long term monitoring of a population of *Delphinium exaltatum* Ait.

Monitoring of a population of *Delphinium exaltatum* Ait. (tall larkspur) was begun in 1985 at the Oak Ridge National Environmental Research Park. Permanent plots (100) were established on a 0.25 km² grid. Plots were identified as one of five habitat types. All individuals in a plot were classified as juvenile, immature or adult and the total number in each class was recorded. Plots were visited annually, excluding 1992 and 1996, with individuals being classified and counted. Total individuals in the permanent plots varied from a high of 192 in 1990 to a low of 38 in 1988 with an average of 100.7. Population size in a given year is positively correlated with precipitation in that year ($r^2=0.139$) and with precipitation in the previous year ($r^2=0.782$). Habitat manipulation (mowing) also appears to influence population size and structure.

- 157 FOWLER, KADRIN E. and JAY F. BOLIN. Old Dominion University—The role of smoked water in seed germination of *Pyxidanthera barbulata* (Diapensiaceae)

Pyxidanthera barbulata Michx., pixie moss, is a prostrate, evergreen subshrub of limited distribution along the mid-Atlantic Coastal Plain. This is a monotypic genus characterized by small linear to oblanceolate leaves and white to pinkish 5-lobed corollas in the early spring. The plant exhibits clinal variation from the xeric form with very small leaves and shorter corolla lobes to a mesic form with larger leaves and flowers. Due to its rarity, little is known about its pollination mechanism, seed dispersal, or germination cues. During the 2005-2006 season, no seedlings were found, suggesting that the species reproduces vegetatively. Pixie moss populations are often found in association with fire-dependent *Pinus* species. In this study *P. barbulata* seeds were watered with 1%, 10% and 100% concentrations of smoked water until germination. Smoked water was made by burning native plant litter and percolating the smoke through deionized water. This study is one of the first undertaken to stimulate seed germination of native plants using smoked water in the eastern U.S.

- 158 HUPP, CLIFF R.¹ AND MASSIMO RINALDI². U.S. Geological Survey¹ and University of Florence²—Riparian vegetation patterns in relation to fluvial landforms and channel evolution along selected rivers of Tuscany.

Riparian vegetation distribution patterns and diversity relative to various fluvial geomorphic channel patterns, landforms, and processes are described and interpreted for selected rivers of Tuscany, Central Italy; special emphasis was given to vegetation – fluvial processes associated with channel evolution (types of adjustment) following various types of human impacts. Riparian vegetation at 13 representative stream reaches in Tuscany was investigated near stream gauging stations. A field survey was conducted for vegetation species, fluvial landforms, and types and amounts of channel/riparian zone changes for each surveyed reach. Inundation frequency of the different geomorphic surfaces was determined and vegetation data were analysed using BDA (Binary Discriminate Analysis) and DCA (Detrended Correspondence Analysis) and related to hydrogeomorphic results. Thirty-two species of woody plants and 49 species of herbaceous plants were identified, and six main surfaces (channel bed, active bar, high bar, benches, floodplain, terrace bank, and terrace) were distinguished topographically and vegetatively. Multivariate analyses revealed distinct quantitative vegetation patterns relative to the major fluvial geomorphic surfaces. DCA of the vegetation data also showed distinct associations of plants to fluvial landforms and processes of adjustment. The DCA clearly separated the plants along a landform gradient. Certain species were found to “prefer/tolerate” varying amounts of incision and narrowing. Species richness increases from the channel bed to the terrace, while species richness decreases from moderate to intense incision and from low to intense narrowing. Multidisciplinary approaches allow for greater environmental interpretation and facilitate the understanding of vegetation and fluvial geomorphic trends and restoration efforts.

- 159 PARAJULI SHANTA¹, YONG WANG¹, WUBISHEH TADESCSE¹, AND CALLIE J. SCHWEITZER². Alabama A&M University¹ and USDA Forest Service, Southern Research Station²—Forest site classification of northeastern Alabama using remote sensing and geographic information system.

Forest site characteristics are important in forest management, especially to ensure sound planning and sustainability of resources. Forest site classification focuses on the land classification system that subdivides forest land into logical segments (land types) and is often based on site characteristics such as physiography, climate, geology, topography, soil, and vegetation. Despite the availability of historic forest site classification data for the Cumberland Region in Jackson County, Alabama, the application of Geographic

Information System (GIS) for current forest site classification has not been explored in this region. This study examines the potential use of GIS, remote sensing, and statistical techniques to classify forest land in northern Jackson County. The preliminary analyses suggested that there was a general agreement between computer generated and expert manually-derived landtype association classification maps. Through the use of a clustering technique, we were able to further classify forest land into 21 classes based on six variables: aspect, slope, elevation, drainage class, soil moisture, and soil texture. The map generated by the computer was complicated and difficult to interpret, and its agreement with expert manually-generated landtypes map was low. We will continue this research by using manually-derived classification criteria to establish a series of "if, then, else" condition statements to assign pixels to specific landtypes. Discriminate function analysis (DFA) and logistic regression (LR) will be used to explore the important geophysical variables to require to separate landtypes.

- 160 REINHARDT, KEITH AND DAN JOHNSON AND BILL SMITH. Wake Forest University—Ecophysiology of broad-leaved treeline species in the Caucasus Mountains of Georgia.

On mountains around the world, much attention has been focused on the altitudinal limits of various plant species that comprise the “treeline”—the altitude where stunted and deformed trees and shrubs are last found. Despite this long-term interest in treelines, the main causes for these limits are relatively unknown for any species. In this study we investigated the physiological ecology of two broad-leaved plants, *Betula litwinowii* and *Rhododendron caucasicum*, that are the dominant treeline species in the Kazbeghi region of the Republic of Georgia to determine what controls carbon gain, water use, and seedling establishment regimes have on controlling treeline altitudes. We measured photosynthesis, transpiration, and leaf chlorophyll fluorescence of both plant species at two elevations at both exposed (grassy subalpine meadows) and protected (northern slope) sites. We found little difference in photosynthesis and fluorescence at the lower sites. At the upper site photosynthesis was higher in the protected plants compared to the exposed plants, while no difference in fluorescence was found between the two upper sites. This suggests that in the dry climate of the interior Caucasus Mountains, the importance of forced convection and microsites on photosynthetic processes and treeline determination increases with elevation.

- 161 SHARITZ, REBECCA, KATHRYN MADDEN AND DON IMM. Savannah River Ecology Laboratory—Habitat characteristics of TES plants of the southeastern Fall Line sandhills region

Sandhills of the southeastern United States that occur along the Fall Line support a unique flora and fauna, including a suite of threatened, endangered and sensitive (TES) species. These sandhills communities have become increasingly fragmented as a result of urban and suburban development and agricultural activities. In addition, the federal government has extensive land holdings throughout this region, including military installations. The ability to predict the occurrence of sandhills woodlands that might contain TES species on these intensely utilized lands may enable the Department of Defense and other land managers to conserve multiple species simultaneously. The objectives of this research are to determine microhabitat characteristics of selected sandhills TES species and to develop methods to evaluate effects of land management activities on these species. Sixty-three populations of nine TES sandhills plant species across three sites (Fort Benning, Fort Gordon, Savannah River Site) were surveyed to describe plant community structure and also soil characteristics and other environmental variables. An NMDS ordination revealed that TES plant populations occur on sites classified as dry hardwood woodland, mixed pine-oak woodland, dry pine savanna, and xeric barrens. Similarly, soils throughout all the sampled populations are excessively

sandy with low soil moisture and organic content. Preliminary data also suggest a relationship between TES plant abundance and canopy openness for some species. These data are being used to build species-specific models to assist land stewards in predicting potential occurrence of TES habitat and aid in conservation efforts.

- 162 WELCH¹, NICOLE TURRILL, DWAYNE E. COLEMAN¹ AND CHRISTOPHER G. MEYER². ¹Middle Tennessee State University and. ²University of Southern California—The chemical influence of *Kalmia latifolia* on *Pinus pungens* seedlings.

Kalmia latifolia, a member of the allelopathically-prone Ericaceae, is native to *Pinus pungens* forests and often described as the fuel ladder necessary to carry fire into the canopy to open *P. pungens*' serotinous cones. In contrast, recent observations suggest that *P. pungens* regeneration is less successful in areas where *K. latifolia* dominated the shrub layer prior to the burn. This study assessed the effects of possible water-soluble chemicals in soils collected under *K. latifolia* on *P. pungens* seedling growth. Three 10-cm soil samples were collected from each of 8 locations where *K. latifolia* was present and absent in a *P. pungens* stand on Thunderhead Mountain in the Great Smoky Mountains National Park, Tennessee. *Pinus pungens* cones were collected from a nearby 25-year-old stand and opened to obtain seeds. Collected soils were compiled by the presence or absence of *K. latifolia* and placed in small clay pots ($n=17$ for each soil type). Control pots contained a standard, unfertilized potting soil ($n=17$). Germinated *P. pungens* seeds were planted one seed per pot, watered daily and grown for 13 weeks in greenhouse and growth chamber conditions. Mortality averaged 3-4 individuals per soil treatment in both greenhouse and growth chamber conditions. Soil treatment did not significantly effect relative growth rate, root weight or shoot weight, respectively, in either greenhouse ($F=0.22$, $P>0.81$; $F=0.13$, $P>0.88$; and $F=0.09$, $P>0.92$) or growth chamber ($F=3.24$, $P>0.06$; $F=0.13$, $P>0.88$; and $F=1.20$, $P>0.31$) conditions. *Kalmia latifolia*'s possible inhibition of *P. pungens* seedling establishment is competitive, but mostly likely not allelopathic.

- 163 DE STEVEN, DIANE¹, REBECCA R. SHARITZ², AND CHRISTOPHER D. BARTON³. USDA Forest Service Southern Research Station¹, Savannah River Ecology Laboratory², and University of Kentucky³—Results from experimental restorations of coastal plain depression wetlands.

Within the context of an experimental project testing approaches for restoring coastal plain depression wetlands, we evaluated the success of "passive" revegetation methods (natural recruitment from seed banks or dispersal) that allow for wetland "self-design" in response to hydrologic recovery. For 16 forested depressions that historically had been drained and altered, surface drainage ditches were plugged to re-establish natural ponding levels, and the successional forest was harvested to open the sites and promote establishment of emergent wetland vegetation. We sampled vegetation composition and monitored water levels one year prior to restoration and for 5 years post-restoration. Related studies evaluated seed banks and tested planting success of selected wetland species. After forest removal and ditch plugging, the restored depressions quickly developed an emergent cover dominated by wetland species recruiting from seed banks. However, drought conditions delayed hydrologic recovery for several years, which allowed undesired non-wetland species to colonize or maintain a presence in the restored vegetation. More stable hydrologic conditions were able to regulate herbaceous plant composition in favor of wetland species, but resprouting woody plants persisted in some wetlands and could alter the future trajectory of revegetation. Passive methods may not fully replicate the composition of reference systems, as some characteristic depression wetland species did not reappear in the restored sites. Test plantings of several tree and grass species were largely successful, indicating that selective planting can be used to augment passive restoration methods.

- 164 JOHNSON, DANIEL M. AND WILLIAM K. SMITH. Wake Forest University—
Effects of cloud immersion on understory light environment and photosynthesis in the southern Appalachian Mountains (USA).

Cloud immersion is a frequent phenomenon in the high-altitude coniferous forests of the southern Appalachians and may be an influencing factor determining the boundary between conifers and the lower-elevation hardwood forests. However, few studies have addressed the impacts of cloud immersion on either sunlight environments or the corresponding effects on plant physiology. The current study monitored understory light environments along an altitudinal gradient on Roan Mountain, NC (USA) and developed a model of photosynthetic carbon gain in understory plants (*Aster divaricatus* and *Eupatorium rugosum* and seedlings of *Abies fraseri* and *Sambucus pubens*) based on actual measurements of photosynthesis and photosynthetically active radiation (PAR) during clear and cloud-immersed conditions. Immersed days were 47% more frequent at the high-altitude sites than at the lower sites. Peaks in understory PAR were reduced by 45 to 69%, PAR was less variable and was also closer to these species' photosynthetic optima on immersed days, as compared to clear days. Photosynthetic light response curves became saturated below $400 \mu\text{mol m}^{-2} \text{s}^{-1}$, and corresponded to the light environment measured under cloud immersion. Although photosynthetic carbon gain was similar on clear and cloudy days, no effects of possible depression of photosynthesis in full sunlight were included in the model. In fact, under high sunlight ($\sim 2000 \mu\text{mol m}^{-2} \text{s}^{-1}$), F_v/F_m in *A. fraseri* seedlings was significantly reduced, indicating that photosynthesis was depressed under full sun conditions. Moreover, compared to clear sky conditions, cloud immersion provided more constant sunlight near the photosynthetic optimum, as well as protection from photoinhibition.

- 165 MORROW, CHRIS AND DANNY J. GUSTAFSON. The Citadel—Does physiological integration among *Spartina alterniflora* ramets reduce the negative effects of grazers?

Spartina alterniflora is a rhizomatous perennial grass that is the dominant plant species in Atlantic and Gulf coast salt marshes. This keystone plant species is a significant contributor to the detritus driven estuary community and has recently been linked to important primary (marsh periwinkles) and secondary consumers (bluecrabs, diamondback terrapins). In a field experiment, we tested whether physiological integration in this rhizomatous grass reduced the negative effects of snail grazing on individual plants. Snail exclusion cages were constructed and placed around individual plants, with these experimental assigned to 1) control (no snails and rhizomes intact), 2) grazing (4 snails) and rhizome intact, 3) no grazing and rhizome cut, and 4) grazing with rhizomes cut. We measured plant performance (total leaves) and snail damage (number of leaves with radula damage) at 2 week intervals from June to September 2005. Our experimental treatments had no effect on the total number of leaves; however, the number of damaged leaves did increase with the addition of snails. Individual plants that had their rhizomes cut tended to have more damaged leaves than those with rhizomes intact. Physiological integration of *S. alterniflora* ramets may provide additional resources to individuals experiencing consumer pressure in much the same way it facilitates vegetative recruitment into anoxic substrates at the low marsh / marine boundary.

- 166 REYNOLDS, LAUREN¹, NICHOLAS MCLETCHIE¹, AND LLOYD STARK².
University of Kentucky¹ and University of Nevada, Las Vegas²—Morphological and physiological differences along an environment gradient in a desert moss.

Phenotypic variation within species across habitats can result from plasticity or genetic variation. The desert moss *Syntrichia caninervis* grows along a light and temperature

gradient: in the understory, light and temperature are low relative to the inter-story between shrubs. *Syntrichia caninervis* appears morphologically distinct between these environments. The ultimate goal of this study is to determine if differences are plastic or genetic. An initial study was preformed to quantify morphological and physiological differences. Shoots were collected in the Mojave Desert from 16 pairs (understory and interstory patches). Shoots were measured for shoot and leaf morphological traits. A subset of pairs (9) was rehydrated for 72hr hours in both a high light and low light conditions. Flourescence (Fv/Fm) readings were taken before, immediately after, 24hr after, and 48hr after a heat shock treatment of 40°C for one hour. Leaf length and shoot length and width were all found to be significantly larger in understory shoots. There was no statistical difference in the initial Fv/Fm between plants from the interstory and understory. However compared to plants in high light conditions, plants from both habitats showed faster recovery in low light 48hr after the heat shock. These results demonstrate that understory shoots are larger than interstory shoots. The Fv/Fm data suggests that the ideal environment for shoot recovery from high heat is low light and the understory is the more favorable habitat. Our next step is to use a common garden to determine if morphological differences are genetic or environmental.

- 167 WYATT, JULIE L. AND MILES R. SILMAN. Wake Forest University—Spatial and temporal patterns of the herbaceous layer due to logging history in Southern Appalachian cove forests.

The understory herbaceous layer of rich cove hardwood forest of the Southern Appalachian Mountains is characterized by high diversity and slow recovery from disturbance. The impact of logging on the diversity of this community has been disputed. Spatial structure of the herbaceous layer in old growth and secondary forests has not been addressed, despite plant performance being influenced by the abundance and identity of neighbors. Models predict that aggregation and segregation promote coexistence by greater intraspecific competition and less interspecific competition, which has not been assessed in this community. Variation in temporal patterns with logging history also needs to be quantified for species composition and abundance across seasons and storage of future recruits in the seed bank. Three old growth and three secondary forests (~100 yrs) were surveyed in the Nantahala National Forest, NC. All individual ramets were mapped in early spring, late spring and mid-summer within ten randomly placed 1m² plots in each cove forest and seed bank samples were taken from each plot. Spatial analyses will be compared for different logging histories and across a temporal scale from spring to summer. Similarity of the seed bank to present vegetation and with logging history will be assessed. Conservation and restoration of the understory herbaceous layer requires an understanding of not only understory diversity, but also community structure across time and space.

- 168 CUMMINGS, JUSTIN AND STEVE OBERBAUER. Eastern Illinois University and Florida International University—Photosynthetic response to leaf temperature regime of tropical plants.

Since 1976, net tropical rain forest warming has increased at a rate of 0.26 ± 0.05 °C per decade along with a global mean land surface temperature rise of 0.22 ± 0.08 °C. If global warming persists and abnormally high temperatures become more frequent throughout the day, a negative impact on the ability of tropical plants to fix atmospheric carbon may begin to be observed. The objectives of this study were to determine leaf temperature regimes in relation to light and ambient temperature and to determine photosynthetic response to midday temperature of tropical plants while maintaining constant vapor pressure deficit. An Omega OS685L Infrared Thermometer with laser sight was used to non-intrusively measure diurnal leaf temperatures of plants in canopy environments in La Selva, Costa Rica. A photosynthetic response to temperature was measured on leaves *in*

situ at light saturation with a LI-6400 portable photosynthesis system using ambient temperature range and maintaining vapor pressure at 1.5 kPa. Overall photosynthetic rates were negatively correlated with temperature over the range of ambient midday temperatures ($P \leq .0001$). Although the results from individual species varied, the combined data set suggests that photosynthesis declines at leaf temperatures greater than 31°C.

- 169 BOLTZ, SARAH K. AND LYTTON MUSSELMAN. Old Dominion University—Morphology and population structure of heartleaves, *Hexastylis virginica* (Aristolochiaceae), in southeastern Virginia.

Hexastylis virginica (L.) Small. is a rhizomatous, evergreen herb distributed throughout the southeastern United States. It is commonly called “heartleaves” and “little brown jugs” due to its cordate leaves and brown-to-purple, flask-shaped flowers. Once a member of *Asarum*, it is now placed in the genus *Hexastylis*. Compared to *Asarum*, little is known about the pollination biology of *H. virginica*. Both genera are of particular interest due to their flowering under the litter layer. Classical pollination studies involve emasculation, which can damage the flowers. To bypass this, molecular markers are used to examine the population structure of three discrete populations in southeastern Virginia. DNA fingerprinting estimates the extent of clonal propagation, selfing rates, and outcrossing rates. This study attempts to answer the following questions: Is clonal growth significant for the reproductive success of the species? Does more genetic variation exist between populations than within populations, suggesting a higher rate of self-compatibility?

- 170 CURRIE, KATE¹, J. MORGAN VARNER², JOHN KUSH³ AND MARTIN CIPOLLINI⁴. Rose Hulman College¹, Humboldt State University², Auburn School of Forestry and Wildlife Sciences³, and Berry College⁴—A survey of the herbaceous vegetation in the Berry College Longleaf Pine Management Area.

The Berry College Longleaf Pine Project is a management project designed to restore a fire-suppressed Mountain Longleaf Pine community to its natural, fire-maintained state. The target communities are frequently burned sites at the Mountain Longleaf National Refuge (MLNR) in Fort McClellan, Alabama. To monitor the progress as management activities (hardwood control, prescribed burning) surveys of the herbaceous vegetation were initiated in the summer of 2005. Following NCVS protocols, surveys were conducted in six study stands. Presence and cover values were obtained for all species encountered, and importance values were generated from these data. The presence of Mountain Longleaf Pine community indicator species was also recorded. Of the top 11 species ranked by importance values, seven were considered to be indicator species of healthy mountain longleaf ecosystem. Nevertheless, principal-component analyses revealed that the Berry College stands cluster together and differ distinctively from the MLNR communities. In particular, there are fewer fire-adapted species and more shade-tolerant, fire-sensitive species in the Berry College stands. Overall, the analysis revealed an ecosystem still suffering from fire suppression, but showing clear signs that recovery has begun.

- 171 ENGEL, E. CAYENNE¹, JAKE F. WELTZIN¹, AND RICHARD J. NORBY². University of Tennessee, Knoxville¹ and Oak Ridge National Laboratory Environmental Sciences Division²—Interactive effects of warming and water availability on NDVI in an old-field community global change experiment.

Global atmospheric and climatic change, particularly increases in atmospheric [CO₂], temperature, and varying precipitation regimes, may alter the structure and function of plant communities throughout the globe through shifts in species composition, resource use and availability, and shifts in phenology. A multi-factor experiment at Oak Ridge

National Laboratory utilizes open-top chambers to administer treatments of elevated [CO₂] (+300 ppm) and elevated temperature (+ 3 degrees C) in a split-plot water treatment design. Plant communities constructed of seven common old-field species, including grasses, forbs, and legumes were constructed in 2002, with the initiation of treatments in 2003. We measured normalized difference vegetation index (NDVI, a spectral reflectance based measure of canopy greenness) during the 2004 and 2005 growing seasons as a way of detecting shifts in plant community phenology (the timing of annual green-up and senescence). Global change studies often find that increased air temperature induces phenological shifts, such as elongation of the growing season, or a shift toward both earlier green-up and senescence. However, we saw no phenological shifts in our system, but rather suppressive interactive effects of warming and water availability on canopy greenness. In addition, the productivity and foliar cover responses of dominant species to treatments are related to responses of NDVI, allowing us to elucidate which species drive community level responses.

- 172 GERSCHUTZ, ANDREW D. University of North Carolina, Chapel Hill—A comparison of niche and neutral theory in old-growth and second-growth hemlock forests.

Two theories that describe mechanisms controlling species richness are the environmental niche hypothesis, which posits that species are adapted to specific microclimates and the most competitive species for a given environment will succeed, and neutral theory, which claims that species richness is independent of environmental variables and relies on birth rate, death rate and dispersal ability. I propose to compare these theories using species richness patterns in old-growth and second-growth hemlock forests of the Southern Appalachians. I predict that dispersal limitation in plant communities will influence compositional heterogeneity in early successional stages, but that environmental niches will become more important later in succession. I will test this prediction using species diversity changes after ten years in old-growth and second-growth forests. I also predict that the species-area relationship will change during succession as dispersal becomes less limiting resulting in higher richness at large scales, and competitive sorting causes lower richness at small scales. I will test this by comparing species-area curves at two time points approximately ten years apart at the same location in old-growth and second-growth forests. It is important to study community dynamics in southern Appalachian hemlock communities because these communities are threatened by the hemlock woolly adelgid and the dynamics may soon change.

- 173 McDONALD, KRIS¹, SARAH HOPKINS^{1,2}, STEVE PERLMAN³ AND LAWRENCE ZETTLER¹. Orchid Recovery Program, Illinois College¹, University of Alaska-Fairbanks², National Tropical Botanical Garden³—The status and propagation of the Federally endangered Hawaiian endemic, *Platanthera holochila* (Orchidaceae).

Platanthera holochila (Hbd.) Krzl. (Orchidaceae), one of three orchid species endemic to the Hawaiian archipelago, is among North America's rarest orchids (U.S. Federal endangered species, C1; global rank G1) with <36 plants thought to remain on three islands (Kauai, Maui, Molokai). We describe an improved protocol to propagate *P. holochila* from seed using a mycorrhizal fungus from Florida [*Epulorhiza repens* (Bernard) Moore, UAMH 9824] on soil-based media *in vitro*. Germination and development on standard oat agar + soil was superior to modified oat medium (MOM), prompting the transfer of 47 leaf-bearing seedlings to a *Sphagnum* moss substrate *ex vitro*. From this total, 6 healthy seedlings were reared and delivered to the Missouri Botanical Garden where they remain in captivity. In an effort to recover fungi critical to *P. holochila*'s survival in its natural habitat, seed baits were buried in soil on Molokai (2003) and retrieved a year later. Three of the recovered protocorms yielded a fungus tentatively identified as an

Epulorhiza sp., and isolates of this fungus were deposited into two international culture collections (CBS, UAMH) for safekeeping and future use. Efforts to utilize this indigenous fungus to germinate seeds *in vitro* using the improved protocol is now underway to facilitate eventual seedling re-introduction *in situ*.

- 174 PITTS-SINGER, THERESA L.¹ AND JOAN L. WALKER². USDA-ARS Bee Biology & Systematics Laboratory¹ and USDA Forest Service Southern Research Station²—Through the eyes of a bee-holder: a look at rare plants of Apalachicola National Forest, FL

Various aspects of pollination were studied for one endangered and two threatened plants in the Apalachicola National Forest, FL. *Harperocallis flava* (endangered), *Macbridea alba* (threatened), and *Scutellaria floridana* (threatened) were observed in the field during bloom to record flower visitation by pollinating insects and to document flower phenology. Photographs of focal flowers also were taken in black and white and in ultraviolet throughout the day and over a few days to document UV coloration and any changes in color patterns. Such UV coloration could be used by bee visitors to assess availability of floral rewards. Results show that bee visitations to these flowers are infrequent, that flowers are open for only a few days, and that UV absorbance is apparent in the flower's reproductive areas. Implications for conservation of these plants will be discussed in light of longleaf pine, *Pinus palustris*, forest management.

- 175 GILLESPIE, EMILY L, CATHERINE M BUSH AND KATHLEEN A KRON. Wake Forest University—Phylogenetic relationships among major clades of Ericoideae (Ericaceae) based on multiple molecular markers.

The Ericoideae (formerly known as Rhododendroideae) are one of several subfamilies that comprise the Ericaceae. Previous research demonstrated that the group known as Rhododendroideae was paraphyletic and as a result was re-circumscribed to include the former Empetraceae and renamed to reflect the type, *Erica* (hence Ericoideae). Four groups are apparent within the Ericoideae and are generally recognized at the rank of tribe. These include Empetreae (*Empetrum* and *Ceratiola*), Rhodoreae (*Rhododendron*, *Menziesia* and *Therorhodion*), Ericeae (*Erica*, *Calluna* and *Daboecia*) and Phyllodoceae (*Phyllodoce*, *Kalmiopsis*, *Epigaea*, *Rhodothamnus*, *Elliottia*, *Kalmia* and *Bejaria*). The Ericoideae are diverse with regard to several aspects of flower morphology (e.g. petal number, petal connation), leaf type (ericoid versus flat) and pollination strategy. Although in recent studies the monophyly of Ericoideae is well-supported, and although some subclades are also well-supported, relationships among tribes within the subfamily are not fully understood. Additionally, membership of some tribes (notably Phyllodoceae) differs among analyses. For example, *Bejaria* is sometimes resolved separately from the remaining Phyllodoceae, as is a *Bryanthus/Ledothamnus* clade, a *Kalmia* clade and an *Elliottia* clade. Conversely, some analyses have placed *Diplarche* (Rhodoreae) within Phyllodoceae. The objective of the present study is to resolve relationships among the major ericoid tribes. The study includes several molecular markers, including *ndhF*, *nrlTS*, *matK*, *waxy* (GBSS-1) and *LEAFY*. Of particular interest is the uncertain membership of Phyllodoceae. Resolution of major clades within the Ericoideae will be followed by an examination of the Phyllodoceae at a finer scale.

- 176 BECK, JOHN AND RANDALL SMALL. University of Tennessee—Phylogenetic history of *Sida* and related genera (Malvaceae) based on chloroplast and nuclear DNA sequences.

The genus *Sida* (Malvaceae, tribe Malveae) is a species-rich group with a global distribution. Generic circumscription of *Sida* has historically been problematic, and a number of segregate genera have been proposed to accommodate species originally

placed in a large and heterogeneous *Sida* s. l. *Sida* s.s. is currently divided into eleven sections based on morphological data, and along with the segregate genera, comprise an informal group known as the *Sida* alliance. A recent phylogenetic analysis of the *Sida* alliance based on nuclear ribosomal ITS sequences recovered a group of *Sida* species (including the segregate genus *Dendrosida*) that represent the *Sida* "Core." This analysis also suggested that *Sida* is polyphyletic and a number of species currently classified in *Sida* are actually more closely related to other genera than to the Core. To complement and extend the phylogenetic analysis based on ITS sequences we have sequenced two chloroplast DNA regions (the *rpL16* intron and the 3' *trnK-matK* intron + portion of the 3' *matK* coding region) for species currently classified in *Sida* and segregate genera. Nuclear GBSSI sequences were also generated for *Sida* species that fall within the Core. The goal of the study is to assess the monophyly of the named sections of *Sida*, the relationships between *Sida* and related genera, and the limits of the Core using chloroplast sequences. Additionally, GBSSI sequences are used to recover relationships between and within individual groups of *Sida* species within the Core.

- 177 MORRIS, ASHLEY B.^{1,2}, ALEXANDRA R. BIGGER^{1,2}, ZERA S. DAMJI^{1,2}, DOUGLAS E. SOLTIS¹, AND PAMELA S. SOLTIS^{1,2}. Department of Botany, University of Florida and Florida Museum of Natural History, University of Florida—Finding refuge in eastern North America: Phylogeographic patterns in American beech and sweetgum.

A regional phylogeographic review of eastern North America indicates that there are several well-documented, congruent patterns of glacial refugia and post-glacial migration routes among plants and animals. However, there are also numerous divergent patterns, likely as a result of differences in life history strategies and ecological requirements. Temperate tree species provide an excellent opportunity for testing long-held hypotheses regarding temperate refugia during the last glacial maximum. The most widely cited idea is that these species persisted in Gulf Coast alluvial valleys, subsequently repopulating ice-free areas as they became available. An alternative hypothesis raised more recently is that temperate species were able to persist in small pockets near the ice margin, as well as in more southerly refugia. We used several non-coding plastid DNA regions to assess the reality of these two hypotheses in American beech and sweetgum, two long-lived temperate trees with different modern distributions and different life histories. Preliminary data indicate a more complicated picture than was previously hypothesized. While traditionally suspected refugia are supported to some extent, new patterns have also emerged. However, due to the limited rate of evolution of plastid sequences within these species, we intend to follow this work with studies using microsatellites in order to obtain a more detailed post-glacial reconstruction of American beech and sweetgum population dynamics.

- 178 MATHEWS, KATHY AND ADAM GRIFFITH. Western Carolina University—The relationships of phylogeny and distribution patterns in *Sabatia* (Gentianaceae).

Sabatia (Gentianaceae) is a group of 21 flowering plant species found mainly on the Atlantic and Gulf Coastal Plains of the southeastern US. Many species have overlapping distributions. Distribution patterns of 15 *Sabatia* species in North Carolina, South Carolina and Georgia were examined to determine whether co-occurring species were phylogenetically closely related (clustering) or not (dispersion). Locality data for each species were taken from herbarium sheet labels, and species occurrences were mapped using ArcGIS software. Species co-occurrences were determined at various spatial scales, including regional and community levels. Phylogenetic relationships were assessed using a phylogenetic hypothesis of *Sabatia* generated from DNA sequence data. The phylogenetic structure of groups of co-occurring species may help explain speciation mechanisms and the maintenance of species diversity in an area.

- 179 FARMER, SUSAN B. AND E. E. SCHILLING. University of Tennessee—Status of the *Trillium pusillum* species complex.

Trillium pusillum is a widespread spring ephemeral of the southeastern United States. The composition of this group in recent taxonomic treatments has ranged from a single species, a single species with up to 6 varieties, or several species. Each of these taxonomic entities is geographically and ecologically distinct. Analysis of chloroplast and nuclear DNA sequence data has clarified the taxonomic boundaries within this group. This sequence data coupled with a morphological analysis has led to a better understanding of these taxa.

- 180 NOBLE, SARAH MARIE AND JUAN LOPEZ-BAUTISTA. The University of Alabama—*Cephaleuros virescens*: a wide-spread subaerial green alga (Chlorophyta, Ulvophyceae) from tropical and subtropical regions.

Cephaleuros is a unique and understudied genus of subaerial green algae (Chlorophyta) found throughout the Southeast USA and in many regions of high humidity world-wide. The generitype, *C. virescens*, was originally described as a fungus. This taxon has been reported in the literature from nearly every tropical and subtropical region, including the Southeast USA. Habitat requirements and current morphology-based classification in *C. virescens* combine to present rather unique research challenges. In order to assess the systematic circumscription and wide-spread distribution of *C. virescens*, samples of this taxon have been gathered from the SE US and overseas. The use of primers specifically designed for the chloroplast-encoded *rbcL* from *Cephaleuros* have been successful in amplifying sequences for phylogenetic analyses. Present results from this study indicate that several entities representing different lineages are currently grouped under the name “*Cephaleuros virescens*”. These taxa share a similar morphology and habitat and may represent a case of morphological convergence. Based on topotype material from the Guyanas, *C. virescens*, appears to be restricted to the tropical Central and South America, with several unnamed species occurring in Southeast USA and overseas. Morphological analyses are in progress to characterize these taxa.

- 181 AL-ZEIN, MOHAMMAD S. AND W. CARL TAYLOR. Old Dominion University—A phylogeny of the endemic quillwort *Isoetes tennesseensis* using the second intron of a LFY homolog

The southeastern United States is home for several diploids, polyploids and interspecific hybrids of quillworts, *Isoetes* (Isoetaceae: Lycopsida). *Isoetes tennesseensis* Luebke & Budke, the first octaploid quillwort ($2n = 2x = 88$) reported from North America, was described from the Hiwassee river in Tennessee. Luebke and Budke suggested that *I. engelmannii* A. Braun and *I. valida* (Engelm.) Clute, as well as their allotetraploid *I. appalachiana* Brunton & Britton, were involved in the evolution of *I. tennesseensis* based on preliminary analysis of ITS sequences as well as distribution data of these taxa. A comparison of sequences of the second intron of a *LFY* homolog for these taxa supports the involvement of *I. engelmannii*, but not *I. valida*, in the evolution of *I. tennesseensis*; sequences suggest that *I. mattaponica* Musselman & Taylor or a close relative with a similar sequence type is the other basic diploid involved. Therefore, it is possible that *I. engelmannii* and *I. mattaponica* have hybridized to produce a sterile diploid which doubled its chromosome number and backcrossed with *I. engelmannii* to produce a sterile triploid. This triploid then doubled its chromosome number and hybridized with *I. engelmannii* to produce a tetraploid, which in turn doubled its chromosome number to produce *I. tennesseensis*. This study confirms the power of sequencing and cloning in resolving complicated and often promiscuous relationships in *Isoetes*.

- 182 TAYLOR, W. CARL. Department of Biological Sciences, Old Dominion University—Phylogeny of *Isoëtes Xaltonharvillii* and *I. appalachiana* as revealed by the second intron of a *LFY* homolog.

Isoëtes is a genus of grass-like lycopods with a conserved morphology that has yet to yield character states useful in resolving a species phylogeny. In addition to basic diploid species ($2n = 2x = 22$), there are many interspecific hybrids and a complete series of polyploids ($2n = 4x = 44$ to $2n = 12x = 132$) indicating allopolyploidy is important in *Isoëtes* phylogeny. Cloning has been used to separate homeologous DNA sequences in several interspecific hybrids and allopolyploids. By comparing these cloned sequences with those of basic diploid species, parent genomes can be identified. *Isoëtes appalachiana* Brunton & Britton, a fertile tetraploid, has been reported from Pennsylvania to northern Florida mostly within the sympatric ranges of the basic diploids *I. engelmannii* A. Br. and *I. valida* (Engelm.) Clute. *Isoëtes Xaltonharvillii* Musselman & Bray, a basic diploid hybrid, is known from western Virginia. Cloning, sequencing, and comparison of the second intron of a *LFY* homolog for these taxa verify that *I. Xaltonharvillii* and *I. appalachiana* contain the genomes of *I. engelmannii* and *I. valida*, but *I. Xaltonharvillii* and *I. appalachiana* contain different sequence types of *I. engelmannii* indicating diverse origins for these hybrid taxa. Cloning and sequencing are useful methods for revealing the phylogeny of allopolyploid *Isoëtes* species.

- 183 ALARID, KHALID M., REBECCA D. BRAY, AND W. CARL TAYLOR. Old Dominion University—The effect of interspecific hybridization and chromosome doubling on spore morphology, orbicule typology, and intercellular pectic protuberances in Isoetes.

Based on its morphology and distribution, *Isoetes appalachiana* Brunton & Britton ($2n = 4x = 44$) has been suspected to be allotetraploid derivative of the basic diploids ($2n = 2x=22$) *I. engelmannii* A. Br. And *I. valida* (Engelm.) Clute. In western Virginia, the interspecific hybrid between *I. engelmannii* and *I. valida*, *I. Xaltonharvillii* Musselman & Bray has been discovered where its parents occur together. These allopolyploid and interspecific relationships have been verified by analysis of their *LFY* intron 2 DNA sequences. Examination of a documented allotetraploid and interspecific hybrid provides an opportunity to describe the effect of chromosome doubling and interspecific hybridization on morphological and ultra structural characters (and their character states) considered to be useful in distinguishing taxa. In this regard, spore morphology, orbicule typology, and the form and texture of intercellular pectic protuberances are studied using the scanning electron microscope.

- 184 BRAY, REBECCA D. AND W. CARL TAYLOR. Old Dominion University—Does morphology mirror molecular data in *Isoetes appalachiana* and *Isoetes Xaltonharvillii* (Isoetaceae)?

In the Appalachian mountains of Virginia, we found two populations of the sterile hybrid *Isoetes Xaltonharvillii* Musselman & Bray. *Isoetes appalachiana* D. F Brunton & D. M. Britton, an allotetraploid of eastern North America from Pennsylvania to Florida has been reported from three counties in Virginia. Recent molecular data show that both of these taxa arose from basic diploid species ($2n=2x=22$), *I. engelmannii* A. Br. and *I. valida* (Engelm.) Clute. However the *I. engelmannii* component in *I. xaltonharvillii* and *I. appalachiana* are different sequence types. The current study of these 4 taxa examines morphology of microphylls (specifically sporangial pigmentation, velum coverage, and stomatal character states) in order to determine if morphological data mirrors molecular data.

- 185 FITZPATRICK, MATTHEW¹, JAKE F. WELTZIN¹, NATHAN J. SANDERS¹, AND ROBERT R. DUNN². ¹University of Tennessee and ²North Carolina State University—The biogeography of prediction error: why does the introduced range of the fire ant over-predict its native range?

The use of species distribution models to predict the spread of biological invasions is an important and rapidly developing area of ecology. Most studies investigating this approach largely ignore deviations between predicted and observed distributions and instead focus on regions where the native range of a species correctly predicts its invaded range. We investigated the ecological significance of prediction errors using reciprocal comparisons between the predicted invaded and native range of the red imported fire ant (*Solenopsis invicta*). We show that introduced populations of fire ants initially established in environments similar to those in their native range, but subsequently invaded harsher environments. Differences in environments occupied by fire ants in North and South America were revealed as over-prediction of the southern boundary of the native range by models developed from the introduced range, suggesting the native distribution of fire ants may not be limited by environmental tolerances. Additionally, using locations where fire ants initially established in North America to predict their native range, we identified a potential origin of introduced fire ants that agrees with genetic analyses of introduced and native fire ants. Taken together, our results provide insight into the factors that govern the distribution and invasion history of exotic species.

- 186 VILLALPANDO, SHAWN and RAY S. WILLIAMS. Appalachian State University—Insect community responses to simultaneous CO₂, temperature, and moisture treatments within an old-field ecosystem.

Atmospheric [CO₂] is approximately 370 ppm and currently increasing by 1.8 ppm yr⁻¹, which could affect the earth's climate via the greenhouse effect. Along with direct effects of increasing [CO₂] levels, future climate change will include increased temperature and concurrent changes in moisture patterns, which represent changes in resource availability for terrestrial ecosystems. The Old-Field Community Climate and Atmospheric Manipulation (OCCAM) experiment studying a plant community and climate change was established in 2002-2003 at Oak Ridge National Laboratory (ORNL), TN. This long-term project is examining an old-field plant community's responses to elevated [CO₂]/temperature and soil moisture regimes. During the 2005 growing season, we characterized the insect community (which addresses multiple trophic level interactions) to examine how multiple climatic factors may alter plant-insect and insect-insect community associations. We also collected leaves from four plant species to quantify carbon, nitrogen (and its ratio), and secondary metabolites important to insects. Using a combination of sticky traps and vacuum sampling, we have identified insects from ten orders, representing several feeding guilds. The sticky trap data show that Thysanoptera is the dominant order, and that it differs significantly in abundance between temperature treatments. Our statistical analysis of abundance data suggests that both main and interactive effects of [CO₂], temperature, and water contribute to observed variation in abundance of several insect taxa and feeding guilds. Although our data suggest multiple climate change factors affect the insect community, it still remains unclear how direct and indirect treatment effects are fully interacting.

- 187 PARADISE, CHRISTOPHER¹, LESLIE SMITH¹, JESSICA CARLSON¹, CHARLIE CHRISAWN¹, AND GRACE METZ². Davidson College¹ and Siena Heights University²—Top-down and bottom-up factors: which is more important in regulating diversity in treehole communities?

In this mesocosm experiment, we examined the top-down effects of *Toxorhynchites rutilus* and bottom-up effects of resource availability on insects in treehole communities. A two-factor fully crossed design used artificial treeholes with two levels leaf litter, and presence or absence of *T. rutilus*. Top predators can increase local diversity by decreasing abundance of a competitive dominant, and thus indirectly affect interactions. The main prey of *T. rutilus* in NC treeholes, and the numerical dominant, is the eastern treehole mosquito, *Ochlerotatus triseriatus*. We hypothesized that *T. rutilus*, by reducing *O. triseriatus* density, allows other species to gain resources. We further hypothesized that the effect of *T. rutilus* would be reduced in mesocosms with high leaf litter resources, due to either increased refugia or decreased competition. Densities of *O. triseriatus* and other common species, and species richness were analyzed using a profile analysis to trace effects of resources and predation over time. Presence of *T. rutilus* reduced densities of fourth-instar *O. triseriatus*, regardless of leaf litter amount. No effect of *T. rutilus* was detected on species richness or densities of other species, but we did detect interactive effects between the level of resources and time. Generally, richness and densities of less common species were higher in conditions of high than low resources, but the magnitude of the effect changed over time. Overall, resource effects were stronger than predation. We conclude that reduction of a dominant species by predation does not lead to increases in diversity, nor does predation interact with resources.

- 188 MARBERT BRYAN S¹, RAY S WILLIAMS, AND PAUL J HANSON². APPALACHIAN STATE UNIVERSITY¹ AND OAK RIDGE NATIONAL LABORATORY²—Ground-dwelling arthropods as indicators of change in forest floor processes due to long-term precipitation alteration.

Global climate change raises a number of concerns for temperate forests, including how reduced precipitation may alter forest floor processes. The focus of this research was to use ground-dwelling arthropods as indicators of environmental change caused by precipitation alterations in an intact hardwood forest. In May 2005, we established five 8 X 8 m plots at two elevations in each dry, ambient, and wet treatment plots previously established at the Oak Ridge National Laboratory Throughfall Displacement Experiment (TDE). Macroarthropods were collected using pitfall traps during late-spring, mid-summer, and early fall. Similarly, microarthropods were collected in litter core samples and extracted using thermal gradient techniques. Litter samples were collected to assess litter mass, phenolic content, carbon:nitrogen ratio, litter moisture and temperature of the forest floor. Total litter mass was significantly greater in the dry treatment (1289.68 g/m^2 , $p < 0.0005$) than in the wet (1051.68 g/m^2) or ambient (974.48 g/m^2) treatments, regardless of elevation. Significantly greater litter mass was found in both the Oi ($p < 0.0257$) and Oa ($p < 0.0037$) layers in the dry treatment, while there was no difference in these leaf litter layers in the wet and ambient treatments. Total arthropod abundance for the late-spring collection was unrelated to treatment ($p = 0.4601$), although there was a significant effect of elevation on abundance (i.e. significantly greater in the upper plots; $p < 0.0027$). Our continuing research will enable us to elucidate more fully the complex interactions between abiotic and biotic factors that affect specific taxa (e.g. ground beetles) exposed to precipitation alteration.

- 189 BHATTARAI, SAMEER AND MICHAEL W. MULLEN. Troy University—Large woody debris and its influence on macroinvertebrate assemblages in southeastern coastal plain streams, USA.

Large woody debris (LWD) has important structural and functional roles in streams, but there is little research to support this view in the southeastern coastal plains. This study surveyed 35 stream reaches in the Choctawhatchee River watershed of southeastern Alabama. These reaches were broadly classified into three distinct categories: urban, forested and mixed. Large woody debris characteristics and functions were quantified.

Pool, sediment characteristics, and drainage areas of each reach were measured along with assessment of macroinvertebrate assemblages. Statistical analyses of LWD, pool, sediment, drainage and macroinvertebrate data were used to examine the relationship among LWD characteristics and functions, pool, drainage and sediment characteristics, and biological variables. There were significant differences in LWD number and volume among the three site categories. These differences apparently resulted in a higher frequency of pools, sediment storage sites and woody debris storage sites, and more ecologically important, heterogeneous habitat in forested streams that contained higher number and volume of LWD. Large woody debris positively influenced macroinvertebrate assemblages and partially abated the negative effect of fine sediment on macroinvertebrates, as indicated by significant positive correlations among LWD, pools and biological variables and an apparent increase in the complexity of in-stream habitat.

- 190 HITT, NATHANIEL¹ AND PAUL ANGERMEIER². Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University^{1,2} and Virginia Cooperative Fish and Wildlife Research Unit²—Effects of stream topology on fish assemblage structure in the mid-Atlantic highlands.

A fundamental challenge in stream fish ecology is to partition local and regional influences on assemblage structure. Numerous studies have identified local determinants of species composition (e.g., competition, predation), but regional influences remain poorly understood. Here, we explore the effects of adjacent streams on local fish assemblage structure. Specifically, we test the hypothesis that the spatial configuration of streams within a watershed (i.e., stream topology) influences refugia and recolonization opportunities for stream fishes. First, we quantify stream topology for 290 sites in the mid-Atlantic highlands based on the size and proximity of adjacent streams. We contrast dendritic and trellised watershed shapes to illustrate stream topology variation among sites. Second, we use data from the USEPA's Environmental Monitoring and Assessment Program to characterize local environmental variation among sites (e.g., substrate size and heterogeneity, large woody debris abundance, thalweg depth, stream width). Third, we partition regional effects of stream topology from local environmental conditions using logistic regressions for species presence-absence data and multiple linear regression for assemblage-level metrics (e.g., species richness, proportion of cyprinids). We conclude by discussing the potential implications for fish assemblage resiliency to anthropogenic stressors.

- 191 GREENBERG¹, CATHRYN H., AIMEE L. TOMCHO^{1,2}, J. DREW LANHAM², THOMAS WALDROP¹, J. TOMCHO³, AND DEAN SIMON³. USDA Forest Service, Southern Research Station¹; Clemson University, Department of Forest Resources²; North Carolina Wildlife Resources Commission³—Effect of fuel reduction treatments on southern Appalachian breeding birds.

Forest fuel accumulation can contribute to the potential for wildfire. However breeding bird response to fuel reduction treatments, such as prescribed fire or mechanical thinning, is not well understood. As part of the National Fire and Fire Surrogate Research Project we compared the effects of three fuel reduction techniques and controls on breeding birds using 50-m point counts in three replicate blocks in southern Appalachian upland forest in North Carolina. Treatments were: (1) prescribed burning (B); (2) mechanical understory reduction (M); (3) mechanical understory reduction + burning (MB), and; (4) controls (C). Breeding birds were surveyed using point counts during 2001 - 2005. Pretreatment data were collected in 2001. Mechanical understory reduction treatments were conducted in winter 2001-2002, and prescribed burns in spring 2003. After treatments (2003) leaf litter depth decreased in B and MB, and snag density and light levels were highest in MB. Shrub cover was significantly lower in all fuel reduction treatments than in C. Total breeding bird abundance was similar among treatments each year except 2005 when it

was higher in MB. Species richness was higher in MB in 2004 and in 2005 due to influx of open-associated species. Most species showed no response. Shrub-associated Hooded warblers were reduced in all fuel reduction treatments compared to C for two years post-treatment (2003 – 2004), whereas Indigo buntings, associated with open habitats, were most abundant in MB during 2004 and 2005. Breeding bird response to fuel reduction treatments was apparently associated with changes in habitat structure.

- 192 MOORE, DEBBIE¹ AND W. SEAN SANDERS². Troy University Dothan Campus¹ and Houston County High School²—A Preliminary Survey of Chiropterans Utilizing Bridges, Culverts and Drain Pipes Found in the Wiregrass Area

In April of 2005, visual inspections began of bridges, culverts and drain pipes located in Houston County, Alabama to determine if chiropterans utilized them as alternative roosting sites. Historic roosting structures such as hollow trees and old buildings have been removed from much of the Wiregrass area to facilitate encroaching development of land for human use. The structures studied contain areas for habitation that are safe from predation and molestation, and that provide suitable environmental conditions. Chiropterans were observed roosting in all of these types of structures. Of the species observed, *Myotis septentrionalis* demonstrated preference for the culverts and drain pipes while *Eptesicus fuscus* and *Tadarida brasiliensis* were found to use all of these structures to some extent. Many of the culverts housed isolated individuals while a small number of the bridges and pipes housed several hundreds.

- 193 JONES, CHRISTOPHER M. AND WADE B. WORTHEN. Furman University—Relationships between morphology and perch height preference in a guild of summer dragonflies.

We surveyed summer dragonflies at five ponds in South Carolina to determine whether perch-height preferences were related to morphology. Males were captured, weighed, digitally photographed, and released. Mean mass, wing loading (N/m^2), forewing aspect ratio, and hind wing aspect ratio were compared across species using ANOVA. We observed species perching on arrays of artificial perches (vertical dowels) placed at each pond. "Low perch" (10, 20, 30, and 40 cm) and "high perch" (20, 40, 60, and 80 cm) arrays were used in separate experiments. The frequencies of perch height use were compared across species using χ^2 tests of independence, and mean perch heights were calculated for each species and were correlated with the morphological measurements. Wind speeds were recorded at experimental heights using flywheel anemometers. There were significant differences among the ten common species in all morphological attributes. Mean body size spanned nearly an order of magnitude, from *Perithemis tenera* (67 mg) to *Libellula vibrans* (633 mg). As expected, wing loading and aspect ratios were positively correlated with mean mass. There were consistent, significant patterns in perch use in both experiments. *Perithemis tenera* used low perches, *Erythemis simplicicollis*, *Plathemis lydia*, *Pachydiplax longipennis*, and *Celithemis fasciata* use intermediate heights, and five large species of *Libellula* used the tallest perches. Mean perch height of these species was significantly correlated with mean mass and hind wing aspect ratio in both experiments. Mean and maximum wind speed also increased with perch height, so large species may prefer taller perches for increased lift.

- 194 OLSZAK, JASON D. AND KIM MARIE TOLSON. University of Louisiana Monroe—A description of small mammal communities in a managed bottomland hardwood forest.

In the development of Louisiana's Comprehensive Wildlife Management Strategy (CWCS) identification of non-game small mammal communities present on state managed land has become a necessity. Bayou Macon Wildlife Management Area (BMWMA) is a

relatively new public land acquisition in northeast Louisiana where such information is lacking. Mark-recapture methods using Sherman live-traps were employed to assess relative abundances of small mammals in each of 5 different habitat designations. 100m² trapping grids (10m spacing) were placed no closer than 150m from habitat edge and run for three consecutive nights each in winter 2004, summer 2005, and again in winter 2005. Abundance is reported as the number of individuals captured/300 trap-nights. Overall, five rodent species were captured and were most abundant in the ten-year-old reforested habitats (.105). The following orders of abundance were shelterwood cut (.09), untreated & natural areas (.009), individual selection cut (.008), and agricultural fields (.003). The biggest contribution to both small mammal abundance and species richness comes from the aforestation activities that have taken place. In an attempt to diversify the canopy in the more mature forests, land managers have enhanced the use of BMWMA by small mammals. State Wildlife Grants have supported this inventory.

- 195 DOFFITT, CYNTHIA M.¹, LINDA M. POTE¹, AND D. TOMMY KING². Mississippi State University¹ and USDA/APHIS/WS²—Morphological comparison and identification of cercariae released by the rams-horn snail *Planorbella trivolvis*

The rams-horn snail, *Planorbella trivolvis*, is commonly found in commercial channel catfish (*Ictalurus punctatus*) ponds in northwest Mississippi. This snail has been found to be an adequate first intermediate host in several digenetic trematode life cycles, including *Bolbophorus damnificus* and *Clinostomum complatum*. These trematodes can cause mortality and the formation of unsightly cysts in the musculature of channel catfish. Infected snails were collected and four major types of cercariae were isolated from these snails. These cercariae are classified as *Bolbophorus* sp., *Clinostomum* sp., amphistome-type, and armatae-type. Morphological comparisons of these cercariae were made using scanning electron microscopy and light microscopy. The cercariae were further identified using molecular analysis. This information will be used to complete unknown digenetic trematode life cycles.

- 196 GRINSTEAD, C. BRAD¹, OSCAR J. PUNG¹ AND KRAIG KERSTEN². Georgia Southern University¹ and Armstrong Atlantic State University²—Distribution of hydrobiid snails and their parasites in salt marsh along the Skidaway River in coastal Georgia.

Hydrobiid snails are the first intermediate host of the trematode *Microphallus turgidus*. As part of a study concerned with the temporal and geographic distribution of *M. turgidus* in southeast Georgia salt marshes, hydrobiid snail populations along the Skidaway River were examined to determine their distribution and the prevalence of trematode infection. To do so, sediment was collected from three to seven 0.5 m² quadrats along 20 vertical transects beginning in the high marsh and ending in the low marsh creek bed. Sediment samples were sieved to concentrate snails and then examined in the laboratory to determine hydrobiid number and species and the prevalence of trematode infection. Two species of hydrobiid snail, *Spurwinkia salsa* (99% of specimens) and *Onobops jacksoni* (1% of specimens) were collected. Hydrobiid snail density was greatest in the higher cordgrass (*Spartina alterniflora*) zones. These zones were also characterized by short- and medium-form cordgrass, the greatest cordgrass density, and the highest richness of other invertebrate species. Hydrobiid snails may prefer the higher cordgrass zones because they are regularly inundated by tidal flooding but, unlike the low cordgrass zone or creek bed, are subjected to the effects of water currents or the presence of swimming predators for shorter periods of time. Approximately 2.5% of *Spurwinkia* snails were infected with 3 different trematode cercariae; 1 monostome (*Phagicola diminuta*) and 2 types of xiphidiocercariae (possibly *Maritrema* sp. and *Microphallus turgidus* or *Microphallus basodactylophallus*).

- 197 BURON, ISAURE DE¹ AND WILLIAM A. ROUMILLAT². Biology Department, College of Charleston, SC¹ and Inshore Fisheries Section, Marine Resources Research Institute, South Carolina Department of Natural Resources²—Histopathology of philometrid nematodes in the southern flounder *Paralichthys lethostigma*.

In South Carolina estuarine systems, the southern flounder is infected by two species of parasitic philometrid nematodes, one of which is of particular interest because individuals are found lined up along the base of consecutive dorsal and anal fin rays. Most worms are found on the pigmented side of the fish and in smaller fish induce a visible bulging of the body. Histological studies showed that worms lay between the depressor and erector muscles of each fin element. Their presence at the base of the dorsal and anal fin rays displaced or thinned the fin inclinator muscles to the extent of eventually causing complete atrophy of these muscles. Some large worms were found to cross the host's median septum, compress the erector muscles and displace uninfected adjacent fin element muscle groups. Because of the importance of these muscles in controlling fin movements, severe infection of the southern flounder by these worms undoubtedly restricts the ability of the fish to capture food and escape predators, consequently affecting their fitness and overall fate in their habitats. Funded by SC Sea Grant Consortium.

- 198 FULLER, CLAIRE A., Murray State University—The relationship between the abiotic environment and the immune function of the Caribbean termite, *Nasutitermes acajutlae*.

Termites are responsible for up to 20% of recycling of woody debris and their relative importance as degraders increases from the temperate zones to the tropics. Changing environmental conditions such as global warming could influence susceptibility of termites to disease either by increasing encounters with pathogens or altering their ability to produce an immune response. I examined the relationship between the abiotic environment (air, soil and internal nest temperature, air and internal nest relative humidity, soil pH and light levels at nests) and two measures of immunity, phenoloxidase (PO) activity and hemolymph protein concentration, using backwards stepwise regressions. I found that PO activity increased significantly with increasing external air temperature ($P < 0.02$) and nest volume (a proxy measurement of termite size; $P < 0.001$). However, protein concentration in the hemolymph decreased with external air temperature ($P < 0.001$) and with the relative humidity of the nest interior ($P < 0.02$). No other environmental variable was significantly related to either immune parameter. Although termites came from a number of discrete habitats (rain forest, dry forest, wetlands, mangrove lagoon and beaches) with different abiotic environments, habitat per se did not appear to influence immunity. This study suggests that the abiotic environment can exert a strong influence on PO activity and hemolymph protein concentrations. Previous studies by other authors have shown that each of these immune parameters is related to susceptibility of insects to bacterial and fungal pathogens. Thus, changing temperature and humidity may influence prevalence of termite diseases.

- 199 CARREÑO, ABIGAIL D.¹, A. RICK ALLEMAN², ANTHONY F. BARBET², GUY H. PALMER³, SUSAN M. NOH³ AND CALVIN M. JOHNSON¹. Department of Pathobiology, Auburn University¹; Department of Pathobiology, University of Florida²; and Department of Veterinary Microbiology and Pathology, Washington State University³—In vivo endothelial cell infection by *Anaplasma marginale*.

Anaplasmosis is an arthropod-borne hemoparasitic disease of cattle and other ruminants. The causative agent is the gram negative bacterium, *Anaplasma marginale*. Infection of bovine erythrocytes by *A. marginale* has been well established *in vivo*, as well as *in vitro*. Recently, *A. marginale* has been propagated *in vitro* in bovine and primate vascular

endothelial cell cultures. This finding provides evidence that infected endothelial cells may initiate MHC-Class-I restricted CTL responses in infected cattle. To determine the extent to which endothelial cells are susceptible to *A. marginale* infection *in vivo*, a dual staining technique was applied to tissues from a splenectomized calf experimentally inoculated with 10^9 organisms from the St. Maries strain of *A. marginale*. Sections of lung, kidney, and hemal lymph node were collected, embedded in freezing compound, frozen in isopentane/liquid nitrogen, and cryosectioned at 5 microns. Sections were co-labeled with monoclonal antibody ANAF16C1, recognizing *A. marginale* major surface protein 5 (MSP5) conjugated to Alexa Fluor 488 and a polyclonal rabbit antibody against human von Willebrand Factor (an endothelial cell marker) conjugated to Alexa Fluor 568. Nuclei were stained with 284nM 4', 6-diamidino-2-phenylindole, dihydrochloride (DAPI). Sections were evaluated by conventional wide field and confocal fluorescence microscopy using a BioRad MRC 1024 Scanning Laser Confocal Microscope. As expected, non-endothelial cells within vascular lumens were the major reservoir for *A. marginale*. In addition, *A. marginale* fluorescence co-localized to capillary endothelial cells of the lung, hemal lymph node, and kidney. These results suggest that endothelial cells may serve as a cellular reservoir for *A. marginale* *in vivo*. (This work was funded by a grant from the USDA-CREES).

- 200 AHN, JUN, JOSHUA ELLIS, DAAIYAH COOPER, HALEY JACKSON, DANA DARMOHRAY, AND ALAN F. SMITH. Department of Biology, Mercer University, Macon, GA 31207—Detection of the causative agents of Lyme disease and ehrlichiosis in individual southern black-legged ticks collected from white-tailed deer of the Piedmont National Wildlife Refuge.

Adult and nymphal ticks were collected from the carcasses of freshly harvested, white-tailed deer (*Odocoileus virginianus*) at the check station during two prescribed hunts in 2004 (Oct. 21-23 and Nov. 4-6) at the Piedmont National Wildlife Refuge (Jones Co. and Jasper Co., GA). The two major tick species were Southern black-legged ticks (*Ixodes scapularis*) and lone star ticks (*Amblyomma americanum*). Collected specimens were stored individually at -20°C , total genomic DNA was extracted from individuals, and aliquots provided templates for the PCR-generation of agarose-gel-electrophoretic identifiable amplicons. Primers were designed from specific gene sequences as follows: a 353-bp *Borrelia* spp. FLA-I gene fragments; a 459-bp *Borrelia burgdorferi* (Lyme disease) rOmpA gene fragment; a 164-bp *Ehrlichia* spp. 16s rRNA gene fragment; and a 900-bp *Ixodes* spp. nuclear ribosomal gene cluster fragment (ITS2). The presence of the *Ixodes*-specific amplicon served as an added control and the confirmed by sequencing the agarose gel-purified amplicons. Of the deer ticks examined, 6.32% and 1.26 % tested positive for *Ehrlichia* and *B. burgdorferi*, respectively. Faculty Research and Development Grants from the College of Liberal Arts, Mercer University provided funding for the project.

- 201 YABSLEY, MICHAEL J.¹, THIERRY M. WORK², AND ROBERT A. RAMEYER². Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, Georgia¹ and U.S. Geological Survey, National Wildlife Health Center, Honolulu Field Station, Honolulu Hawaii²—Molecular phylogeny of *Babesia poelea* from brown boobies (*Sula leucogaster*) from Johnston Atoll, Central Pacific.

The phylogenetic relationship of avian *Babesia* with other piroplasms remains unclear, mainly because of a lack of objective criteria such as molecular phylogenetics. In this study, our objective was to sequence the entire 18S, ITS-1, 5.8S, and ITS-2 regions of the rRNA gene and partial β -tubulin gene of *B. poelea*, first described from brown boobies (*Sula leucogaster*) from the central Pacific, and compare them to those of other piroplasms. Phylogenetic analyses of entire 18S rRNA gene sequence revealed that *B. poelea* belonged to the clade of piroplasms previously detected in humans, domestic

dogs, and wild ungulates in the western United States. The entire ITS-1, 5.8S, ITS-2, and partial β -tubulin gene sequence shared conserved regions with previously described *Babesia* and *Theileria* species. The intron of the β -tubulin gene was 45-bp. This is the first molecular characterization of an avian piroplasm.

- 202 PALMIERI, JAMES R., Ph.D¹, KATHERINE BARTER, BS, MT², MELISSA HRICKO, BS³ AND MARIE PALLOTT⁴. Department of Microbiology, Division of Biomedical Sciences, Virginia College of Osteopathic Medicine¹, Virginia Polytechnic Institute Department of Biochemistry^{2,4} and Center for Molecular Medicine and Infectious Diseases Virginia Maryland Regional College of Veterinary Medicine^{1,2,4} and Virginia Commonwealth University, Department of Clinical Laboratory Science, Richmond VA³—Low temperature induction of *Acanthamoebae* trophozoites from dormant cysts influences their ability to phagocytize bacteria.

Free-living *Acanthamoeba* are commonly found in aquatic biofilms. *Acanthamoebae* exist in both the trophozoite feeding and the highly resistant and dormant cyst stage. *Acanthamoebae* and pathogenic bacteria are closely involved in complex symbiotic relationships. In a study by Abd (2003), *F. tularensis* (tularemia) survived and developed within *A. castellanii*. How *F. tularensis* exists in its silent stage in nature and its relationship to naturally occurring acanthamoebae in soil and aquatic environments remains unknown. When acanthamoebae are placed in adverse conditions, (pH, nutrient depletion, increased salinity), trophozoites change into highly protective cysts. Presently, we are studying the mechanisms of cold temperature on *F. tularensis* survival and colonization in trophozoite and cyst forms of *Acanthamoeba*. In nature, *F. tularensis* may survive for extended periods in cold environments while acanthamoebae may remain in the cyst stage for up to 24 years. At lower temperatures, we found a unique and unreported variation in the behavior of three species of *Acanthamoeba* [*A. astronyxis* (nonpathogenic), *A. castellanii* (semi pathogenic) and *A. culbertsoni* (highly pathogenic)]. When dormant cyst stages are lowered to 18C-3C, cysts revert back to trophozoites. As temperatures are lowered to -2C, all newly formed trophozoites eventually encyst. Experiments are presently underway to determine if these cold-induced trophozoites are capable of feeding on *F. tularensis* which may explain how *Francisella* exists in its silent-cycle and may elucidate its relationship with *Acanthamoeba* in nature. This relationship represents one of the most scientifically intriguing questions to be answered concerning the epidemiology and natural transmission of tularemia.

- 203 ROSYPAL, ALEXA C.^{1,2}, DWIGHT D. BOWMAN³, DANIEL HOLLIMAN¹, GEORGE J. FLICK¹, AND DAVID S. LINDSAY¹. Virginia Tech¹, University of North Carolina at Chapel Hill², Cornell University³—Effects of high hydrostatic pressure processing on *Ascaris suum* eggs.

High hydrostatic pressure processing (HPP) has been shown to be an effective non-thermal means of inactivating non-spore forming bacteria and some protozoa from various food products. Little information is available regarding the effects of HPP on metazoan parasites. Outbreaks of food-borne disease have been associated with importation of food contaminated with fecal material. *Ascaris suum* is used as a surrogate model metazoan parasite for the human roundworm, *Ascaris lumbricoides*, to study the effects of treatments on the inactivation of eggs in sludge. The present study was conducted to determine the effects of HPP on *A. suum* eggs. Unembryonated *A. suum* eggs were collected from sewage and examined prior to HPP treatment. Eggs were subjected to 138 to 552 Mpa for 10 to 60 seconds in a commercial HPP unit. Embryonation was induced after HPP treatments by incubating eggs in 0.01 N sulfuric acid at room temperature. After 21 days, 100 eggs were examined per treatment using a light microscope and the percent of embryonated eggs was determined. Morphological alterations were not observed in the

HPP treated eggs. Embryonation was induced in 38-76% eggs that were subjected to 138 and 270 Mpa. No embryonation was observed in eggs exposed to pressures of 241 Mpa or more for 60 seconds or in eggs exposed to 276 Mpa for 10 to 30 seconds. These results indicate that HPP treatment could be used to protect contaminated food items by inactivating *A. suum* eggs and may also have potential in reducing food-borne illness resulting from fecal contamination. This study was financially supported in part by an Animal Health and Disease grant to DSL and GJF.

- 204 STOCKDALE, HEATHER D.¹, G. SHANE WEST², TED HANKES³, KENNETH L. MCMILLAN⁴, MARK WHITLEY⁵, CHRISTINE C. DYKSTRA¹, JENNIFER A. SPENCER¹ AND BYRON L. BLAGBURN¹ Auburn University College of Veterinary Medicine¹, Vestavia Animal Clinic, Birmingham, AL², Alford Animal Veterinary Hospital, Birmingham, AL³, Pell City Animal Hospital, Cropwell, AL⁴, and Cobb Animal Clinic, Greensboro, NC⁵—*Tritrichomonas foetus* induced large-bowel diarrhea is an emerging disease in domestic cats.

The first reported clinical case of intestinal trichomoniasis in cats was in 1956. Since 1996, there have been numerous reported cases of feline trichomoniasis. Our lab has received four separate feline fecal specimens from cats throughout Alabama and North Carolina in which trichomonads were observed by direct fecal examination (direct smear). The cats demonstrated chronic diarrhea and bacteria overgrowth. These cats were treated with a combination of metronidazole, fenbendazole and enrofloxacin. Prior to treatment, trichomonads from each of the four naturally infected cats were recovered using TF InPouch assay (Biomed Diagnostics, White City, Oregon) and successfully cultured in TYM Diamond's Media. Genomic DNA was extracted and results of a single-tube nested polymerase chain reaction (PCR) using specific *Tritrichomonas foetus* primers verify *T. foetus* infection. The PCR products were cloned and sequenced and these results were compared to *T. foetus* strains referenced at GenBank. Large-bowel diarrhea caused by *T. foetus* is an emerging disease in domestic cats. *Tritrichomonas foetus* is observed most commonly in the reproductive tract of cattle. The correlation between the large bowel disease in cats and reproductive disease in cattle is unknown.

- 205 WILSON, K. G., D. A. FRANCKO, M. A. LOKUGE, LI LU, B. STRENG, M. OSMAN, and C. LEARY-ELDERKIN. Miami University—Zygotic embryos from palms as a research tool

In our studies on cold-hardy palms we found it necessary to develop methods to quickly and efficiently remove embryos for study. We find that the embryos grow faster than seeds under axenic conditions. It is often difficult to grow many varieties of palms axenically because of fungal contamination. Zygotic embryos isolated from the seed seem to be clear of fungi. Our techniques for embryo extraction were developed using *Sabal palmetto* and *S. minor*, but they seem to work for several palm varieties, including *Trachycarpus fortunei*, *Rapidophyllum hystrix*, *Phoenix canariensis*, and *P. dactylifera*. The two major problems in extracting zygotic embryos from *Sabal* seeds is the hard coat and locating the embryo. Soaking the seeds for several days in 20% bleach solution may or may not soften the coat, but it helps to locate the embryo in all species tested to date. Areas external to the embryo develop a different color appearing as a spot about the diameter of the embryo. In some species the embryo is identified by a lighter color in others by a darker color. Tests indicate that the bleaching facilitates rapid growth of the resulting embryos. The utility and growth of extracted zygotic embryos will be discussed.

- 206 AL-ZEIN, MOHAMMAD S., KHALID M. ALARID, KUSHAN U. TENNAKOON AND LYTTON J. MUSSELMAN. Old Dominion University—Floral development and style ontogeny in Michauxia campanuloides L'Hér. (Campanuloideae: Campanulaceae)

Michauxia campanuloides L'Hér. is a poorly studied herbaceous dichogamous monocarpic biennial inhabiting rocky outcrops of the Eastern Mediterranean. Its flowers are 8-merous and display secondary pollen presentation typical of the Campanuloideae. Scanning electron microscopy and light microscopy are utilized to examine the development of floral parts and nectaries, as well as the ontogeny of stilar hairs, in comparison with other genera in the Campanulaceae sensu latu. Emphasis is placed on the sequential growth of the filaments and the style in relation to pollen presentation. Results of this ongoing study are employed to delimit *Michauxia*.

- 207 WILLIAMS, JOSEPH H.¹ University of Tennessee, Knoxville—Evolution of the progamic phase in flowering plants.

In seed plants, the progamic phase is defined as the developmental period between pollen reception by the sporophyte and fertilization of the egg. The duration of the progamic phase is a consequence of interactions between up to five genetically distinct tissues: male sporophyte (proteins on pollen wall), male gametophyte (pollen tube), female sporophyte (nucellus and/or carpel tissues), and female gametophyte (egg cell and central cell, which may or may not be genetically distinct from each other). The genetic component of variation in duration of the progamic phase is thus a consequence of the co-evolution of these ontogenies. What metric should we use to describe evolutionary changes in this set of co-occurring ontogenies? The simplest metric is the time between pollination and fertilization, as reported in many embryological studies. This metric has the advantage of incorporating many complexities in a single measure. Evolutionary developmental studies typically trace the modification of a single ancestral ontogeny, but in the case of the progamic phase phylogenetic variation can arise due to differential modification of more than one ancestral ontogeny. Thus comparative studies of the progamic phase are still in their infancy, perhaps due to the complexities of accurately describing the temporal and spatial dimensions of multiple ontogenies that cannot be visualized *in vivo*. In this paper I report the duration of the progamic phase in a number of basal angiosperms, and I interpret the data in light of the major evolutionary transition in this life history character between non-flowering seed plants and angiosperms.

- 208 ARIAS, TATIANA. University of Tennessee—Architectural analysis of *Vismia baccifera* (roots and shoots) and *Vismia macrophylla* (roots) (Clusiaceae)

The architecture of the root and shoot systems were examined in *Vismia baccifera* and *V. macrophylla* (Clusiaceae). The root systems of both species display a large number of similarities in their axes, however *V. macrophylla* exhibits a lower number (one) of hierarchic levels and seems to complete its architectural units sooner than *V. baccifera*. The architecture of *V. baccifera* corresponds to Attim's model while that of *V. macrophylla*, to Troll's model. Roots and shoots develop asynchronically, not simultaneously, and in general root systems of both taxa tend to show more kinds of axis than the shoot system. Several significant differences were found in the shoot architecture among these species and other, previously examined, in the genus *Vismia*, in particular those regarding the secondary plagiotropy, unstable monopodia and inflorescence position.

- 209 TENNAKOON, KUSHAN U.^{1,2}, JAY F. BOLIN¹ AND LYTTON J. MUSSELMAN¹,
Department of Biological Sciences, Old Dominion University, Norfolk, VA
23529¹ and Department of Botany, University of Peradeniya, Sri Lanka² –
Hydnora - Euphorbia association: a model to investigate osmotic relationships of parasitic plants.

Hydnora is a rare and intriguing genus of subterranean holoparasitic plants in Southern Africa. Even though a number of studies have been conducted on the morphology and the habit of this genus, very little is known about the structural and functional attributes. We selected the *H. triceps*: *E. dregeana* association to unravel the osmotic relationships of this genus. Contact between the endophytic tissue of *Hydnora* haustoria with the host root ranges from direct lumen-to-lumen links between the xylem elements and continuity between the phloem sieve elements as well as transfer cells. The □¹³C signals of *Hydnora* dry matter (-13.49±0.19) mirrored those of the host *E. dregeana* (-13.43±0.22). This provided conclusive evidence of close synchronization of parasite carbon metabolism with the CAM pathway of the host. Percentage nitrogen content of *Hydnora* dry matter was about 3 times lower than *Euphorbia*. Significant levels of K and P enrichment (15.79±2.62 and 1.86±0.2 mg g⁻¹ respectively) were recorded in *Hydnora* compared to the parasitized host roots (6.40±0.99 and 0.98±0.18 mg g⁻¹ respectively). Almost all other common mineral elements and soluble NO₃⁻ levels were appreciably lower in *Hydnora* dry matter. Structural and functional studies provided evidence of water flux from host to parasite by slow diffusion and osmosis. K⁺ could be an important compatible osmolyte responsible for maintaining a lower water potential in *Hydnora* than in the hosts. This study provides a background for future investigations of possible cellular mechanisms involved with the osmotica of root holoparasites.

- 210 FRANCKO, DAVID, KENNETH WILSON, CATHLENE LEARY-ELDERKIN, CASI THOMPSON, AND MUNA OSMAN–A putative new cultivar of *Musa basjoo* (Japanese fiber banana) for general landscape use.

Bananas have long been popular in subtropical/tropical landscapes because few species evoke a more tropical feel. Recent years have seen the introduction of several cold-hardy banana species into the marketplace. Of these, the Japanese fiber banana (*Musa basjoo*) is by far the most cold-hardy and is becoming popular with U.S. gardeners in USDA Zone 8b and colder. Foliage is undamaged by frost and hardy to about 28F, pseudostems are hardy to about 23F, and mulched specimens are root-hardy to -20F. In USDA Zone 8 and colder, mature specimens of wild-type *M. basjoo* grow to about 10-15 ft in height each growing season, and in areas without prolonged winter cold mature specimens can reach 18-20 ft. Flowering occurs on mature 2nd-year pseudostems and is thus extremely rare in cold winter areas. We describe a putative sport of *M. basjoo* that has been growing on the Miami University campus in Oxford, OH for the past 6 years and which has now been successfully propagated via tissue culture. We have termed this sport 'Upham Giant' and are seeking new cultivar/trademark status for it and its propagules. This sport reaches 21-22 ft in height at maturity under Zone 6 conditions, regrows from pseudostems rather than root buds even after subzero cold, has much larger than normal foliage, and occasionally flowers on 1st-year growth. Such enhanced characteristics under rigorous Zone 6 conditions suggest that this putative new cultivar could be ideally suited for temperate landscape use in much of the U.S. and southern Canada.

- 211 PRICE, STEVEN J., JOY M. HESTER, AND MICHAEL E. DORCAS. Davidson College–Habitat use of resident and relocated eastern box turtles.

Knowledge of habitat use is vital to understanding the effects of management strategies on animal populations. The relocation of box turtles from degraded sites to natural areas is a management strategy often proposed to mitigate the impacts of habitat destruction on

box turtle populations; however few studies have examined how relocated turtles use habitat in comparison to resident turtles. From May 2004 to June 2005, we used radio-telemetry to examine macrohabitat and microhabitat use of 10 resident and 10 relocated female eastern box turtles on the Davidson College Ecological Preserve, an 89-ha natural area characterized by mixed forest and old fields bisected by dirt paths and power-line corridors. We found that both relocated and resident turtles preferred forested habitat over other habitat types, however inter-individual differences were evident. Additionally, both relocated and resident turtles were found closer to dirt roads and power-line corridors than expected, suggesting the preference of edge habitat. Our results suggest that relocated and resident turtles select for habitat in a similar manner. However, the presence of appropriate habitat into which turtles are being released does not assure relocation success, as our previous research has demonstrated that relocated turtles had higher mortality and disappearance rates than resident turtles.

- 212 GOOD, CELESTE D.¹, THOMAS K. PAULEY¹ AND PATRICK KEYSER². Marshall University¹ and MeadWestvaco Corporation²—Constructed ponds as mitigated habitat for Wood Frogs (*Rana sylvatica*) and Spotted Salamanders (*Ambystoma maculatum*)

Amphibian monitoring is important for successful conservation practices in timbered forests. Three ponds were constructed in 3 forested areas on MeadWestvaco's Wildlife and Ecosystem Research Forest in Randolph County, WV. To determine habitat suitability for breeding and larval amphibians, studies were conducted in 6 ponds during 2004, and all 9 in 2005. Drift fence methods with paired funnel traps (16 per pond) were used for amphibian captures. Species of focus included *Rana sylvatica* and *Ambystoma maculatum* because they are known to be philopatric thus providing data on the continued use of these ponds as breeding sites. During both years, trapped amphibians were measured and given 1 pond specific mark with viable implant elastomer. In 2005, juveniles were given individual tags. Breeding *R. sylvatica* (n = 15) were captured in early spring 2005. No breeding *R. sylvatica* were captured in 2004. In 2005, juvenile captures (n = 146) increased from 2004 (n = 30). No *A. maculatum* were captured. Phenological differences between ponds, possibly due to elevation or hydrology, will be presented. Adult *R. sylvatica* increased pond use, while larval success in ponds remains to be seen. Tadpoles did not successfully metamorphose from 2 ponds in 2005. Clear-cut treatments surrounding the ponds will be applied in 2006 and results will be compared to these baseline data.

- 213 KAYLOR, S. DOUG AND THOMAS K. PAULEY. Marshall University—Ecology of Ambystomatidae salamanders in an ephemeral wetland in Mason County, WV.

Amphibian diversity continues to decline, due in large part to the loss of habitat. In order to learn more about population sizes, breeding cycles and habitat use in a wetland by Ambystomatid salamanders, an ephemeral wetland in Mason County, West Virginia was studied where four of five *Ambystoma* species found in the state are likely to occur (*A. jeffersonianum*, *A. maculatum*, *A. opacum* and *A. texanum*.) Three 50 ft aquatic drift fence arrays were placed in combination with collapsible minnow traps. In addition solitary minnow traps were placed throughout the study area. Adult salamanders captured were identified to species, and morphometric data was taken. Individuals were then marked using a single code for mark-recapture analysis with visible injection elastomer and returned to point of capture. Larval salamanders were identified to species, staged, measured for length and returned to capture site. Locations of egg clutches were also mapped and counted. From the beginning of February 2005 to the end of March 2005, 85 adult *A. texanum* were marked. Data shows that this breeding habitat is crucially important to the conservation of *A. texanum* in West Virginia.

- 214 HAENEL, GREGORY J., ALEX GUESS AND GLENN BUTERA. Elon University—Enrichment of lizard DNA libraries for microsatellite sequences: wash away your troubles.

Microsatellites are short sequences of repeated DNA that are very useful in ecological and behavioral studies for measuring genetic relatedness. We isolated microsatellite DNA in Eastern Fence lizards, *Sceloporus undulatus*, and tree lizards, *Urosaurus ornatus*, for use in future population studies. During this process we investigated the relative efficiency of DNA library enrichment for four repeats (CAn, AATn, GGATn, and GACAn) in these two species. DNA from each species was digested with restriction enzymes and ligated to linkers (SNX). This DNA was PCR amplified, then enriched for repeat sequences using Streptavidin magnetic beads in conjunction with a magnetic separator and biotin labeled repeat DNA. Enriched libraries were cloned into pCRII®-TOPO® vector and transformed into TOP10 competent cells (Invitrogen). Insert DNA from positive clones (white colonies on LB-ampicillin, X-gal plates) was directly amplified with PCR. Dot blots were used to screen these clones for the repeat sequences. A subset of these clones was sequenced to verify the results. CAn repeats were found in 35.7% of the clones and AATn repeats occurred in 25.3%. The increase in proportion of clones containing the target repeats after a second enrichment was dramatic. GGATn/GACAn repeats were found in 6.8% of the positive clones after one round of enrichment, while a second round of enrichment yielded an increase to 34.6%. The four base repeat GGATn was much more common than GACAn in Tree lizards. In these lizards the frequency of repeats appears to be inversely proportional to their size.

- 215 DAVIS, KAREN M. University of Tennessee Knoxville—Emydid turtles exhibit social behavior in a naturalistic setting.

Turtle social behavior is little studied in spite of their phylogenetic position as either the most basal reptile taxon or the sister taxon to the highly social birds and crocodilians. Although parental care, ubiquitous in birds and crocodilians, is lacking in turtles, they do interact during feeding, courtship, and basking. Nevertheless, detailed studies of social dynamics from a comparative perspective, especially of aquatic turtles, are rare. Social interactions of an established mixed species group of closely related freshwater turtles (Emydidae) were studied in a naturalistic enclosure. Video sequences of underwater turtle interactions were analyzed. Turtles were found to interact and spend time in close proximity, with individuals of their own or most closely related species. The behavioral repertoire used and frequency of social interactions varied seasonally. Social behaviors were documented and grouped into three categories: agonistic, courtship, and general social. Social interactions were seen in all sexual pairings and frequency of social behavior category differed significantly with sexual pairing. Intense agonistic interactions were more prevalent with male-male pairs, courtship interactions were more common with female-male pairs, and generalized social interactions were seen in female-female pairs. Some agonistic interactions included intense harassment of a smaller, newly introduced, male by coalitions of two or more larger males. These findings indicate that turtles are active social animals that interact with specific individuals.

- 216 MCGUIRE, SAMUAL B. AND GREGORY J. HAENEL Elon University—Hybridization between two lizard species, *Urosaurus graciosus* and *Urosaurus ornatus*: evidence from mitochondrial DNA and morphology.

Boundaries between species are often not clear cut and gene trees may not accurately reflect species trees if introgression has occurred. Introgression is real and should be recognized in a species' history. We investigated hybridization between Long-tailed Brush lizards, *Urosaurus graciosus*, and Tree lizards, *Urosaurus ornatus*. These are

morphologically distinct species found in the southwestern United States. There is overlap of these species ranges in central Arizona but their habitats are relatively distinct. To analyze hybridization we used both mtDNA sequence data and scale morphology. PCR (Polymerase Chain Reaction) was performed to amplify 307 base pairs of Cyt B from individuals of both species. PCR product was purified using gel electrophoresis and spin columns. DNA was sequenced by a commercial DNA sequencing facility. Genetic distance (*p*) was compared among individuals of each species. Three of 9 individuals collected from *U. graciosus* populations had *U. ornatus* type Cyt B sequence that was significantly different from that of other *U. graciosus* (Bonferroni test for multiple comparisons; $F=52.90$, $p<0.001$). None of the 34 *U. ornatus* individuals had mtDNA similar to *U. graciosus*. Over 20 scale characters were also measured on these lizards. Cluster analysis of scale morphology showed that features of hybrid individuals did not differ from native *U. graciosus* individuals. Therefore, it appears that while mtDNA is introgressing into *U. graciosus* populations from *U. ornatus*, morphological traits are not being impacted. This may be because mtDNA in these species is not under the same selective constraints as nuclear genes.

- 217 VIERNUM, SARA E. AND GEORGE R. CLINE. Jacksonville State University—Crevice use by salamanders in northeastern Alabama with an emphasis on the green salamander, *Aneides aeneus*.

Northeastern Alabama supports a high diversity of salamanders, approximately twenty-eight species represented by five families (Ambystomidae, Cryptobranchidae, Plethodontidae, Proteidae, and Salamandridae). These salamanders utilize terrestrial, aquatic, and fossorial habitats. Crevice use by terrestrial, Plethodontid salamanders was studied at two locations in DeKalb County; DeSoto State Park and Boy Scout Camp Comer. DeSoto State Park was relatively undisturbed, while both undisturbed and heavily disturbed sites were found at Camp Comer. Crevices in sandstone rocky outcrops located in mixed deciduous forests were surveyed bi-weekly beginning in May 2005. Height, width, and distance to ground for each inhabited crevice were recorded at each site. Five species of salamanders were collected: *Aneides aeneus*, *Plethodon glutinosus*, *Eurycea longicauda*, *Pseudotriton ruber*, and *Notophthalmus viridescens*. The most abundant species were *A. aeneus*, *P. glutinosus*, and *E. longicauda*. These three species appeared in the crevices about the same time in May. Both *A. aeneus* and *P. glutinosus* were observed regularly, while *E. longicauda* occurred sporadically. *A. aeneus* occupied shorter and narrower crevices, while *P. glutinosus* occupied crevices that were higher from the ground. Only *A. aeneus* was found at the disturbed sites of Camp Comer. *A. aeneus* densities appear higher in the disturbed sites than the undisturbed sites. Seasonal activities were also recorded for *A. aeneus*. Morphological reproductive structures, such as well-developed yellow mental hedonic glands on males, were noted in June. A brooding chamber containing approximately eight eggs was discovered in August. Hatchlings from the brooding chamber appeared in October.

- 218 BRENT, THOMAS R. University of South Carolina Upstate—Sampling methods for studies of freshwater turtles: does methodology influence our estimates of abundance, richness, and diversity?

Researchers use a diverse array of methods to collect freshwater turtles for ecological studies (e.g., basking traps; baited traps; etc.). All of these methods exhibit their own unique set of advantages and disadvantages. However, each technique is also biased and may not produce comparable results. Unfortunately, there is a paucity of quantitative studies to examine how such factors influence our estimates of turtle abundance and diversity. This study describes a field experiment designed to examine how choice of bait influences perceptions of turtle abundance and diversity. I specifically addressed the following questions: (1) does the mean number of turtles captured by each of the baits

differ, and (2) is there significant agreement among the estimates of relative abundance yielded by the various baits?

- 219 SUTTON, WILLIAM B.¹, YONG WANG¹, AND CALLIE J. SCHWEITZER².
Alabama A&M University¹, USDA Forest Service²—Amphibian and reptile habitat relationships in forest stands scheduled for disturbance: pre-treatment results.

Understanding habitat influences upon amphibian and reptile communities is essential for forests currently under a disturbance regime. This study presents pre-treatment analysis of habitat factors and the roles they play in constructing amphibian and reptile communities. Pre-treatment habitat and herpetofaunal variables were collected from eighteen experimental forest stands located within the William B. Bankhead National Forest, Alabama. These plots represent forest stands that are scheduled for forest disturbance. Experimental design for this study consists of a three by two factorial randomized complete block design. Disturbance factors included three thinning levels (no thin, 11 m²ha⁻¹ residual basal area (BA), and 17 m²ha⁻¹ residual BA) and two burn treatments (no burn and burn). Ten habitat variables were assessed along three random line transects within each plot (54 total habitat plots). Amphibians and reptiles were collected by drift fences from April-November 2005. Canonical correspondence analysis (CCA) was used to determine and evaluate habitat features responsible for structuring herpetofaunal communities. Thirty-five total species (17 amphibian species and 18 reptile species) were captured throughout the sampling period. Pre-treatment evaluation of habitat factors is necessary to determine long term effects of forest disturbance on amphibian and reptile communities.

- 220 WEBB, CLIFFORD J. AND CLINE, GEORGE Jacksonville State University—
Habitat Use by Plethodontid salamanders in Northeast Alabama

Plethodontid salamanders form complex communities in small streams. This fifteen-month study examines physiological/morphological trends, habitat usage, seasonal activities and reproductive phenology of seven Plethodontid salamanders. The following salamanders were collected: *Eurycea cirrigera*, *Eurycea guttolineata*, *Desmognathus conanti*, *Plethodon glutinosus*, *Plethodon serratus*, *Gyrinophilus porphyriticus* and *Pseudotriton ruber*. The study site is in the North-East corner of Alabama, in Talladega county (33° 32'57.4"N, 85°49'23.7"W) in Talladega National Forest. Three reaches in a seasonally intermittent stream were studied. Each reach contained three different hydro geomorphic units with one repeat per reach. Three open-ended PVC pipe traps and leaf-litter bags were placed in each of the geomorphic units at each site. *Eurycea cirrigera* was by far the most abundant salamander collected with all developmental stages observed. Adult *Eurycea guttolineata* were encountered infrequently, but they were always found on stream margins. *Desmognathus conanti* were second in abundance to *E.cirrigera*. *Plethodon glutinosus* were always found in the riparian zone under debris or in leaf litter bags. *Plethodon serratus* only appeared in cold, wet winter months and always under debris away from the stream. *Gyrinophilus porphyriticus* were always found in the stream and only as larvae. *Pseudotriton ruber* appeared in very low numbers and only terrestrial adults were found usually under rotted logs. *E.cirrigera* and *D.conanti* were in highest abundance in riffle areas. Larval *E.cirrigera*, *D.conanti* and *G.porphyriticus* were identified from the stream. All larvae collected were also in highest abundance in riffle areas.

- 221 QUINN, JOHN AND DR. KIM MARIE TOLSON. University of Louisiana at Monroe—Mechanisms of parasitic egg rejection in two members of the family Mimidae.

Original theory stated that avian hosts of parasitic Brown-headed Cowbirds (*Molothrus ater*) were clearly classified as an acceptor or rejector of parasitic eggs. Recent work

forces reconsideration of this statement. Northern Mockingbird (*Mimus polyglottos*) rejection was reported at 60%. Percent rejection by the Brown Thrasher (*Toxostoma rufum*) has been documented at both 58% and 96%. The objective of this study is to determine proximate mechanisms involved in Northern Mockingbird and Brown Thrasher response to parasitic eggs of the Brown-headed Cowbird by testing if habitat suitability influences the likelihood of rejection, if host brood size influences rejection frequency, and if egg coloration influences the probability of rejection. During the summer of 2005 model cowbird eggs were placed in the nests of brooding Mimids within northeast Louisiana. Thirteen Brown Thrasher nests were parasitized. The model or real cowbird egg was ejected at each nest. Nine Northern Mockingbird nests were artificially parasitized. Six birds ejected the egg within two days. Of the final three, one nest was predated on day three and the final two nests were abandoned. No significant interaction has been found between habitat suitability, brood size, egg coloration and rejection of the parasitic egg. A second field season will begin in April 2006 with the objective of obtaining a larger sample size and exploring the action of ejection versus abandonment in the Northern Mockingbird. Data collected will improve our understanding of proximate response mechanisms to avian brood parasitism.

- 222 HAYES, LOREN¹, ADRIAN CHESH¹, and LUIS EBENSPERGER². University of Louisiana at Monroe¹ and P. Universidad Católica de Chile².Functional significance and fitness consequences of group-living in *Octodon degus*.

Understanding the evolutionary significance of sociality i.e., the propensity of individuals to form groups is critical to developing sociality theory. The objective of our ongoing study is to determine the current utility and fitness consequences of group-living in the degu (*Octodon degus*), a widely distributed and understudied Chilean rodent. Between June and August 2005, we determined the size and composition of N = 11 degu social groups at Riconanda de Maipu, a Mediterranean shrubland habitat located 20 km SW of Santiago, Chile. Initially, we determined the location of degu burrows using radio-telemetry. Once the location of social units was established, we conducted burrow trapping, habitat sampling, and radio-telemetry to determine the relationship between group size and access to (i) primary foods, (ii) burrow systems, and (iii) burrow openings.

- 223 GILLAM, ERIN H and GARY F MCCRACKEN. University of Tennessee–Intraspecific variation in the echolocation calls of Brazilian free-tailed bats, *Tadarida brasiliensis*.

Echolocation is an important sensory process in bats that will be shaped by local environmental conditions as well as evolutionary patterns of gene flow. Determining if geographic variation exists in echolocation call structure has been investigated for a few species, but results are varying. The objective of our first study was to perform a large-scale assessment of geographic variation in echolocation of Brazilian free-tailed bats, *Tadarida brasiliensis*. Within the US, these bats are divided into two subspecies. While behavioral differences exist between these subspecies, genetic data show no geographic structure and indicate the two groups share a common gene pool throughout North America. Our results indicate differences in call structure exist between sites, but that the pattern of variation is not related to geographic or climactic variables. The objective of our second study was to test if high frequency insect calls influence the echolocation call structure of Brazilian free-tailed bats. We performed a playback study in which we broadcast insect calls at varying frequencies to free-flying bats in South Central Texas. Results indicate that bats are shifting their echolocation calls to avoid spectral overlap with this high intensity, ultrasonic sound source. Overall, observed differences in call structure between locations probably do not represent permanent population differences, but instead are short-term adaptations to local foraging conditions, such as the observed shift in call structure related to insect sounds.

- 224 SMITH, JAMES H. Jr., SUSAN MORGAN, GERHARD W. KALMUS and JEAN-LUC SCEMAMA. East Carolina University, Department of Biology, Greenville, N.C., 27858—Developmental gene expression during Caco-2 cell differentiation.

Clustered *Hox* genes encode a conserved family of transcription factors that have been shown to be critical for appropriate segmental patterning of the anterior-posterior axis of developing bilaterian embryos. *Hox* genes have also been implicated in the maintenance of adult tissue differentiation. In the adult, each tissue presents a unique pattern of *Hox* gene expression. Our laboratory has been interested in digestive tract differentiation. Gut development is characterized by a unique pattern of endodermal and mesodermal differentiation, discernibly based on morphological, biochemical and histological properties. Human colon cancer cell in culture, such as Caco-2 or HT-29 cells, have been shown to spontaneously differentiate post confluence into enterocytes. Thus, these cells represent an interesting model to study the mechanisms involved in gut differentiation. The objective of the present study is to analyze *Hox* gene temporal expression during Caco-2 cell differentiation. We chose to focus our study on the paralog group 9-13 *Hox* genes, since it was shown in chick embryos that they are involved in hindgut specification and boundary determination. Caco-2 cells grown in culture for two weeks post confluence were expressing characteristic enzyme profiles of mature enterocytes as measured by RT-PCR and immunocytochemistry. *Hox* gene expression was measured in the exponentially growing and the differentiated Caco-2 cells. RT-PCR analysis shows that some *Hox* genes, such as *Hoxd13*, are present during exponential growth but not after differentiation, while *Hoxd10* show an increase in transcripts post differentiation. Results suggest that *Hoxd10* is a potential regulator of gut development and enterocyte differentiation.

- 225 KING, JUDY A., DIEGO F. ALVAREZ, AND MARY I. TOWNSLEY. University of South Alabama, Mobile, Alabama—Correlative microscopic analysis of pulmonary endothelial leak sites.

Disruption of the endothelial cell (EC) barrier leading to pulmonary edema is linked in part to calcium entry via transient receptor potential proteins (TRP). Since lung ECs arise from different embryological origins and acute lung injury is often heterogeneous, we hypothesize that diverse calcium entry paradigms selectively target distinct EC populations along the pulmonary circulation. EC permeability was assessed in lungs from anesthetized rats by the filtration coefficient (Kf). Kf was measured at baseline and after 45 minutes of constant perfusion with different calcium entry agonists: thapsigargin (150 nM) to induce calcium entry via the store-operated calcium channels TRPC1 and TRPC4, 4α-phorbol-12,13-didecanoate (4αPDD, 3 □M) or 14,15-epoxyeicosatrienoic acid (14,15-EET, 3 □M) both to promote calcium entry via TRPV4, or vehicle (DMSO). Then, the lungs were either perfused with methyl methacrylate for vascular corrosion casting and analysis by scanning electron microscopy (SEM), or glutaraldehyde for light and transmission electron microscopy (TEM). Leak sites were determined by the appearance of perivascular cuffing, disruption of EC junctional complexes, or EC blebs. Although all three calcium entry paradigms increased Kf ~3-fold, they targeted different vascular compartments. Thapsigargin induced perivascular cuffing and disruption of junctional complexes in extra-alveolar vessels, but had no effect on septal EC. In contrast, 14,15-EET and 4αPDD caused blebs in septal capillaries. 4αPDD also induced infrequent perivascular cuffing and blebs in extra-alveolar vessels. Based on SEM and TEM results, we conclude that calcium entry via different TRP channels is associated with distinct EC injury “finger prints” in the rat pulmonary circulation.

- 226 TUBERTY, SHEA R.¹ AND CHARLES L. MCKENNEY, JR². Appalachian State University¹ and U.S. Environmental Protection Agency²—Ecdysteroid responses of estuarine crustaceans exposed through complete larval development to juvenile hormone agonist insecticides.

Fenoxycarb and pyriproxyfen are insecticides that gain their toxicity by specifically acting as insect juvenile hormone agonists (JHA), and so are endocrine disruptors by design and effectively prevent larvae from maturing into adults. Efforts to assess the environmental effects of JHAs on nontarget populations of invertebrates have resulted in the utilization of several established estuarine crustacean models. This work was conducted to test the hypothesis that the mortality, inhibition of development and decreased fecundity reported previously in these animals from JHA exposure coincides with abnormal circulating titers of ecdysteroids. Gravid female grass shrimp (*Palaemonetes pugio*) and mud crabs (*Rhithropanopeus harrisii*), species with different developmental plasticity and JHA tolerances, were collected and held at wet lab conditions (20 ppt salinity, 25 °C) until larval release. Larvae were collected <12hrs after hatch and exposed to JHAs during a static renewal test through end of development with seawater or nominal concentrations of JHA previously shown to induce significant developmental delays and/or decreased body weights. Larvae were subsampled (10 larvae/sample, n=2 to 8) at each developmental stage, lyophilized, and ecdysteroids extracted by homogenization in 80% methanol and elution from C18 Sep-Pak cartridges with 25%, 60% and 100% methanol to capture the polar, free, and apolar conjugates, respectively, and then quantified by ELISA. As was expected significant differences in successful completion of development (larval survival), developmental duration, and growth (dry weight) were observed. These physiological perturbations were linked with significantly altered ecdysteroid titers, supporting a newly emerging theory that juvenoids possibly act as anti-ecdysteroids through a novel molecular mechanism involving inhibition of ecdysteroid signaling.

- 227 SUPER, PAUL E. ¹, LES SAUCIER¹ AND CHARLIE MUISE². Appalachian Highlands Science Learning Center of the National Park Service¹ and Great Smoky Mountains Institute²—A Bird in the hand: optimizing the data and educational value of captured birds in Great Smoky Mountains National Park.

Great Smoky Mountains National Park has held breeding season bird banding since 2000. The banding stations are in two locations: at Tremont on the Tennessee side of the park (425m) and at Purchase Knob on the North Carolina side of the park (1460m). The primary purpose of the project is participation in the Monitoring Avian Productivity and Survivorship program (MAPS), monitoring population parameters of the half dozen species most commonly netted: Louisiana Waterthrush, Chestnut-sided Warbler, Veery, Song Sparrow, Dark-eyed Junco, and Gray Catbird. We have attempted to make the most out of the opportunity while the birds have been in the hand. Ectoparasites, haematozoan (malarial) parasites, biting flies, and gut endoparasites have been collected and identified as a part of the park's All Taxa Biodiversity Inventory, in collaboration with researchers from a ten institutions. Genetic material was collected for studies of species-level markers and migration patterns. The banding stations have also served as training areas for dozens of students from middle school, high school, and college. Some of the results of these studies will be discussed, along with the benefits of involving a variety of research and educational goals in a single project.

- 228 CARPENTER, JOHN P.¹, YONG WANG¹, AND CALLIE J. SCHWEITZER². Alabama A&M University¹ and USDA US Forest Service²—Status of the Cerulean Warbler in northern Alabama: Current population estimates and habitat characteristics.

The Cerulean Warbler (*Dendroica cerulea*) is currently experiencing one of the most precipitous population declines of any Neotropical migratory bird species in North America and is rarely detected in Alabama, the southern-most extension of its breeding range. In 2005, researchers at Alabama A&M University and the US Forest Service monitored the state's three remaining Cerulean Warbler populations: one in Bankhead National Forest (BNF) and two in Jackson County, Alabama. Each Cerulean Warbler encountered was marked with a Global Positioning System and assigned a relative vertical and horizontal perch position. Additional measurements taken during encounters included: tree species, height, diameter at breast height (DBH), and crown class. Point counts were also performed to census all avian species. A total of approximately 40 Cerulean Warbler pairs, including seven females and four fledglings, were detected from late April-early July. Cerulean Warblers used an average tree height of 24.95 m (N=194), DBH of 35.61 cm (N=200), and were observed most often in the outside (44.4%, N=194), upper canopy (46.8%, N=197) of co-dominant trees (51.7%, N=202). In addition, three males were mist-netted, measured, and banded and are, to the best of our knowledge, the only breeding Cerulean Warblers ever captured in Alabama. Relationships between bird locations and landscape features, habitat plot (0.04 ha) analysis, and avian associations of Cerulean Warblers will also be discussed.

- 229 WICK, JILL M. AND YONG WANG. Alabama A&M University—Breeding bird communities of pine-hardwood forests in Bankhead National Forest, AL.

We present pretreatment results for a study evaluating avian response to forest thinning and prescribed burning in the Bankhead National Forest, AL. The experimental design for this study consists of a randomized complete block design. Line-transect surveys were conducted at twenty-seven plots in mixed-pine hardwood forests during the breeding season (mid May – mid July 2005). Forty-one species of songbirds were recorded. The most abundant species was the red-eyed vireo (*Vireo olivaceus*) (350 detections), which was present on all of the plots, followed by the pine warbler (*Dendroica pinus*), also present on all of the plots and detected 182 times. Diversity was calculated using the Shannon-Weiner diversity index; mean index value was 2.530 (± 0.22). This portion of the study is essential for establishing baseline data for our future research.

- 230 PEARSON, SCOTT M. AND ALAN B. SMITH. Mars Hill College—Composition of breeding bird communities along the Blue Ridge Parkway.

The Blue Ridge Parkway provides a transect of over 750 km through the mountains of western North Carolina and Virginia and passes through the major elevation zones and many vegetative community types in the southern mountains. Breeding bird communities were sampled along this transect using 10-min point counts at 267 locations repeated twice per season for two years. The four districts of the Parkway were significantly different with respect to species abundances and community composition. Environmental correlates, including elevation, vegetation type, and land-use patterns in the surrounding landscape, explained differences the bird community among districts. The Plateau District in southern Virginia had the greatest number of open and shrub habitat species due to adjacent agricultural lands. The most southern Pisgah District had the greatest number of high elevation, boreal forest species such as Red-breasted Nuthatch. The most unique combination of species was found at the James River in the Ridge District of Virginia. While elevation was the strongest correlate within a district, it failed to explain biogeographic trends along the southwest to northeast progression of this park. For example, Cerulean Warblers and American Redstarts were much more abundant in Virginia than in North Carolina. The inventory recorded 119 species on the point counts. The most abundant species were forest generalists (e.g., Red-eyed Vireo, Ovenbird) and edge species (e.g., Rufous-sided Towhee and Indigo Bunting).

- 231 REILLY, CAROLYN D., JAKE F. WELTZIN AND E. CAYENNE ENGEL. University of Tennessee—Effects of *Lespedeza cuneata* on species-level dynamics, community composition and structure, and ecosystem processes under global climate change.

Field studies that examine the interactive components of climate change, such as increased atmospheric CO₂ concentration, increased air temperature, and changes in soil moisture availability, are important for understanding species-, community- and ecosystem-level changes that may occur in such a climate. We studied these effects on a constructed old-field ecosystem consisting of C₃ and C₄ grasses, forbs, and N-fixing legumes in an open-top chamber experiment initiated in May 2003. Throughout the growing season, we collected data on several above- and below-ground processes, including species-specific foliar cover, nutrient availability and soil respiration, among others, and found that *Lespedeza cuneata* became the dominant species in several of our communities, having the greatest foliar cover of the constituent species. At the community level it had a negative impact on species diversity and evenness. In addition, we are investigating *L. cuneata* effects on ecosystem processes such as nutrient availability and soil respiration. By examining effects of *L. cuneata* paired with climate change treatments, we can test possible underlying mechanisms driving the observed changes in this old-field system.

- 232 SINGHURST, JASON R.¹, EDWIN L. BRIDGES², AND STEVE L. ORZELL³. Texas Parks and Wildlife Department¹, Botanical and Ecological Consultant², and Avon Park Air Force Range, Florida³—Regional and edaphic patterns of plant composition and diversity in herbaceous seepage slopes and bogs of the West Gulf Coastal Plain.

Herbaceous-dominated seepage slopes and bogs are specialized natural communities which are relatively rare and scattered throughout the Coastal Plain of the eastern United States. They are most commonly found in regions with deep sandy surface soils, at locations where groundwater from the surficial aquifer emerges on sideslopes or at the base of slopes. Soils can vary from totally mineral soils on slopes to deep muck or peat soils in stream valleys fed by seepage. In the West Gulf Coastal Plain, most of these sites are found in only two natural regions – the Longleaf Pine Region of southeast Texas and adjacent Louisiana, and the Post Oak Savanna region of east-central Texas. Sites in the Longleaf Pine Region are mostly found on the Catahoula, Willis, and Bentley Formations of Miocene and Quaternary age. Almost all sites in the Post Oak Savanna region are associated with Eocene age sand formations – the Carrizo, Sparta, and Queen City Sands. Seepage slopes and bogs of the West Gulf Coastal Plain can be divided into six geographic regions which correlate with edaphic conditions and species composition – 1. Quaternary terraces of southeast Texas and southwest Louisiana, west to Polk County; 2. Catahoula and Willis high terraces of southeast Texas and southwest Louisiana, west to Polk County; 3. Central Post Oak Savanna region from Robertson County north to Wood County; 4. Upper West Gulf Coastal Plain, north of the Catahoula Formation and east of Smith County; 5. South-central Post Oak Savanna region from Milam and Burleson counties southwest to Gonzales County; and 6. Antlers sand region of southeast Oklahoma. Although all of these regions have some areas with strong seepage, only the first three of these support *Sarracenia alata* and the most restricted of seepage slope associated species. The floristic composition of these communities has been studied by the authors at over 250 sites throughout the West Gulf Coastal Plain. Many of these sites support over 100 vascular plant species in the relatively small extent of this natural community, with the most diverse sites having 130 to 170 species. There are numerous floristic differences between seepage slopes between these regions, with the strongest distinction being between southeast Texas and Post Oak Savanna examples. The variation in topographic position and degree of seepage hydrology between sites strongly

influences species composition. Many regionally and locally rare plants are found primarily in seepage slopes and bogs. In Post Oak Savanna sites, these include *Aster puniceus* var. *scabricaulis*, *Xyris chapmanii*, *Cladium mariscoides*, *Cirsium muticum*, and *Zigadenus densus*. Several seepage slope plants which are rare rangewide reach their western limit in Texas, including *Lachnocaulon digynum*, *Platanthera integra*, *Rhynchospora stenophylla*, *Xyris drummondii*, and *X. scabrifolia*. Other species are relatively common west to southeast Texas but very rare in the Post Oak Savanna region, including *Aletris aurea* and *Lachnocaulon anceps*. Most of the known sites in southeast Texas are on large timber company or federally-owned land, whereas most of the sites in the Post Oak Savanna region are on large privately owned ranches. Cooperative agreements with interested landowners and managers are essential for the long-term preservation of the full diversity of these natural communities and their unique flora.

- 233 ADAMS, CHRISTOPHER A. AND MELISSA B. DUDLEY. Shorter College—Biomass allocation in *Ligustrum sinense* Lour. (Oleaceae) exposed to varying light regimes.

Ligustrum sinense Lour. (Oleaceae) is an evergreen, invasive shrub that has become a nuisance in the southeastern United States since introduction from Asia. Research dealing with the plant's response to varying light regimes has been lacking in the literature. This study was designed to gather preliminary data on the species' response to varying light regimes: full sun, partial shade, and full shade. Plants in each treatment were harvested after 30 days and the biomass accumulation for the various organs determined. It was determined that plants grew best in partial shade conditions with regard to total biomass production and plant height. Plants grown in full sun produced the least biomass and were smaller. This study provides preliminary information that scientists may find useful in establishing management plans for this species. Furthermore, it provides an established starting point for more comprehensive research in biomass allocation in response to environmental factors.

- 234 BOLIN, JAY F. Old Dominion University—Heat shock germination responses for three eastern temperate forest species.

Heat shock, a mechanism to break physical dormancy of hard seeds, is widely used to account for recruitment in fire maintained ecosystems. The main body of literature is from Mediterranean climates: fynbos of S. Africa, chaparral of S. California, and scrublands of W. Australia. Despite extensive work by fire ecologists in the southeastern United States, heat shock response has only been demonstrated for eight eastern temperate species. In this study, dry heat and wet heat germination responses were investigated for three hard-seeded species, *Galactia regularis*, *Lupinus perennis*, and *Rhus copallina*. Control, wet heat (1 min. boiling), and dry heat (10 min. at 60, 70, 80, 90, 100, 110 °C) treatments were independently applied. All species demonstrated significantly greater germination for dry heat treatments relative to control groups. Maximum germination occurred at 80 °C for *G. regularis* and *L. perennis*. For *R. copallina*, maximum germination occurred at 90 °C for three of four populations, while very low germination rates were observed across all treatments in the fourth population. Heat shock germination trends for the southeastern flora and management implications for threatened hard-seeded species will be discussed.

- 235 FRALISH, JAMES S. AND MIR L. FERDOUS. Southern Illinois University—Linking forest response to measurable soil water, nutrient, and topographic characteristics: what samples, calculations, and parameters are important?

For decades, forest researchers have attempted to relate forest growth (e.g., site index) or productivity (total biomass or its surrogate stand basal area) to measurable soil water and nutrient characteristics. Few early attempts were completely successful. The age and

height (site index) of *Quercus alba* trees and soil and topographic data were collected from 72 stands at Land Between The Lakes National Recreation Area in Kentucky and Tennessee. Statistically, site index was not related to the soil texture fractions (sand, silt, or clay), water holding capacity (%), or nutrient levels (PPM) of either the A or B horizon. However, percent available water between field capacity and permanent wilting point, bulk density, and horizon depth were integrated to estimate the available water capacity (AWC in cm) for a given horizon. Horizon AWC was reduced by the percentage of stone (particles > 2.0 mm). These AWC values were summed for all horizons to 90 cm (maximum rooting) or to a zone impermeable to roots (bedrock or fragipan). The final value was considered an estimate of total available soil water. Horizon nutrient levels (in PPM) were converted to km/ha and summed for all horizons to rooting depth. We found *Quercus alba* site index strongly related to distance to opposing slope or to lake shore ($r = 0.78$, $p < 0.0001$), calcium (lnCa; $r = 0.61$, $p < 0.0001$), slope position ($r = 0.76$, $p < 0.0001$), transformed aspect ($r = 0.66$, $p < 0.0001$, AWC ($r = 0.46$, $p < 0.0001$), and Magnesium ($r = 0.28$; $p < 0.0003$). In stepwise multiple regression, these variables accounted for 90% of the variance. Our results indicate that data from limited surface sampling or that unconverted water or nutrient values for deeper horizons are inadequate to characterize the soil and identify definitive forest growth-soil-site relationships. It appears that the soil reservoir and topography (microclimate determining rate of water loss) have an equally important influence on growth

- 236 JENKINS, MICHAEL A.¹, JOSE, SHIBU² AND PETER S. WHITE³. National Park Service¹, University of Florida² and University of North Carolina-Chapel Hill³—Impacts of dogwood anthracnose and associated changes in community composition and structure on foliar calcium cycling in Great Smoky Mountains National Park.

Because of the high calcium content of its foliage, *Cornus florida* (flowering dogwood) has been described as a calcium “pump” that draws calcium from deeper mineral soil and enriches surface soil horizons. However, over the last two decades dogwood anthracnose (*Discula destructiva*) has decimated populations of this once common understory species. We used long-term monitoring data, soil and foliage samples, and foliar biomass equations to examine the ecological role of *C. florida* in calcium cycling and to identify changes in annual foliar calcium cycling over a 20-year period across five forest types: alluvial, typic cove, acid cove, oak-hickory, and oak-pine. At a given level of soil calcium availability, *C. florida* foliage contained greater concentrations of calcium than other species. Between two sampling intervals, 1977-79 and 1995-2000, the annual calcium contributions of understory foliage declined across all forest types; declines ranged from 26% in oak-pine stands to 49% in acid coves. Loss of *C. florida* was responsible for only 13% of this decline in oak-pine stands, but accounted for 96% of the decline in typic coves. In oak-hickory and oak-pine stands, we observed large increases in the foliar biomass of *T. canadensis*, a species with calcium-poor foliage that increases soil acidity. Increases in overstory foliar biomass and calcium offset understory losses in alluvial, typic cove, and oak-pine stands but not in oak-hickory and acid cove stands.

- 237 METHVEN, ANDREW, CHARLES PEDERSON, BRENT WACHHOLDER, AND VINCE HUSTAD. Eastern Illinois University—Site and host specific variation in corticolous lichen assemblages in coastal floodplain forests.

Weeks Bay National Estuarine Research Reserve, a microtidal estuary located on the eastern shore of Mobile Bay in Alabama, embraces a variety of terrestrial habitats including coastal floodplain forests. Forests adjacent to Weeks Bay are dominated not only by deciduous species such as tupelo, water oak, live oak and sweet bay but gymnosperms including bald cypress, slash pine and longleaf pine. While some of the forests are relatively undisturbed, others have been negatively impacted by agriculture,

timber cutting, and turpentine production. The effects of these disturbances on biotic communities within the reserve are largely unknown. Surveys of corticolous lichens were conducted along three permanent transects, one located in an area of former row crop agriculture (R-1), a second within a pine plantation formerly used in turpentine production (C-2), and a third inside a relatively undisturbed interpretative nature walk (C-1). Lichen assemblages were analyzed using multidimensional scaling (MDS) based on the Bray-Curtis Index of Similarity. Differences in lichen assemblages on all trees and on sentinel trees were determined with an Analysis of Similarity test (ANOSIM). Overall, corticolous lichen assemblages on trees in the C-1 transect differed ($p < 0.01$) from those on the C-2 and R-1 transects but the C-2 and R-1 lichen assemblages did not differ significantly. Spatial homogeneity of lichen assemblages was observed on sweet bay in the R-1 and C-2 transects (both of which differed from C-1 sweet bays) and on water oak in the C-1 and C-2 transects (both of which differed from R-1 water oaks).

- 238 MURRELL, ZACK E. Appalachian State University—Community standards and SERNEC: Building a powerful research tool.

Herbaria are not simply repositories of plant specimens, they are repositories of a tremendous amount of information. Current technologies provide an opportunity to access this information at an unprecedented scale. The real power of herbaria as research tools can be fully realized when both large and small collections within a broad geographic region are electronically available and searchable. SERNEC (SouthEast Regional Network of Expertise and Collections) is designed to facilitate this process, by building partnerships, encouraging the utilization of the collective expertise of the network, and assisting herbaria in providing information to the public. SERNEC is 1) networking the 150 herbaria in 15 states in southeastern North America, 2) developing a strategy for advancing each state's ongoing databasing effort, and 3) working to publish online botanical resources that will be available to scientists, land managers, state and federal agencies, educators and the general public. These data will provide a greater understanding of one of the most botanically diverse regions of the earth and will lead to better research, better management planning and a more well-informed public. A critical aspect of this effort is the development of community standards. Community standards will allow researchers to effectively explore the collective database. Development of a searchable collective database at a regional scale will provide a powerful research tool, and by combining 150 years of botanical information housed in herbaria in the Southeast with models of past plant migrations and current ecological parameters, we can revolutionize studies in biodiversity, evolution, ecology and systematics.

- 239 MORITZ, TOM. American Museum of Natural History—A Conservation Commons.

"The "commons model" provides a framework for assuring open access and responsible use of biodiversity information. In this framework systematic provision is made for both logical synthesis and technological integration within the domain of biodiversity science." A presentation of current commons developments in the context of biodiversity conservation will be made.

- 240 RABELER, RICHARD K.¹ AND JAMES A. MACKLIN². University of Michigan¹ and The Academy of Natural Sciences, Philadelphia²—Herbarium networks: advancing specimen data capture through cooperation.

A Workshop on Herbarium Networks was held in September 2004 at Michigan State University. Out of this gathering, a bold challenge arose: to capture the data of all specimens in United States herbaria by 2020. It was immediately recognized that standards, and tools that employ them, would be required at all stages of the data capture

process. Of primary concern is the amount of work required to capture the data from an estimated 95 million specimens compared to the limited resources currently available in the herbarium community. Several promising technological advances have the potential to make capture of data from specimens and data processing more rapid. A second, often overlooked advantage is the duplication of specimens, common in herbaria. Ideally, the data from a voucher should be entered once rather than by each herbarium holding a duplicate of that collection. Sharing data directly between herbaria through the use of distributed networks holds great promise to speed data capture, aid in quality control, and especially to reduce duplicative effort.

- 241 PEET, ROBERT K¹, JESSIE B. KENNEDY² AND NICO FRANZ³. University of North Carolina at Chapel Hill¹, Napier University², and the National Center for Ecological Analysis and Synthesis³—Names are not sufficient: the challenge of documenting organism identity.

Accurate identification and labeling of organisms is a critical part of collecting, recording, and reporting biological data. Names are also required for any subsequent re-interpretation or reuse of archived data, and for discovery of articles and archived datasets. However, unless biologists label their data according to an agreed, stable naming standard, it will be impossible to accurately resolve, integrate and compare datasets with respect to the entities studied. Unfortunately, owing to the continual discovery of new information, a standard naming system with static, globally unambiguous identifiers for groups of organisms is unattainable. Although time-tested rules of nomenclature determine which scientific names should be applied to taxa in a particular taxonomic classification, these classifications evolve over time. Because the processes of nomenclature and taxonomy are partly independent, the circumscriptions of the organisms associated with scientific names may vary with taxonomic revision or taxonomic authority cited. Consequently, a valid scientific name can have multiple taxonomic interpretations and multiple scientific names can refer to the same taxon. Taxonomic concepts provide an alternative, less ambiguous approach for documenting organism identity, and international standards for their application have recently been adopted. This solution requires researchers to provide adequate references for all taxonomic identifications, either directly or by an identifier that links to a public archive. Application of this approach will allow dramatic improvement in the discovery and integration of distributed taxonomic and ecological data. We regard the use of taxonomic concepts as a key component of any strategy for managing on-line access to biodiversity data.

- 242 WEAKLEY, ALAN S. UNC Herbarium, North Carolina Botanical Garden, University of North Carolina at Chapel Hill—Analysis of change in the flora of the Carolinas from 1933 to 2006: concepts, names, ranks, and discoveries.

For the Carolinas, 928 more taxa are now recognized than were treated in Radford, Ahles, and Bell (1968), an increase of 26%. Such a level of change may seem very surprising for a supposedly well-studied temperate flora, and has implications for systematic botany, bioinformatics, biodiversity studies, and applied conservation. Sources of change include the naming of new taxa, the detection of native taxa not previously known in the area, the new establishment of alien species, changes in taxonomic opinion regarding the validity of segregate species or infrataxa, nomenclatural changes related to the ICBN, and recircumscriptions at the generic and familial levels. The application of “concept-based taxonomy” to the Carolinas’ flora allows the distinction of circumscription changes from rank or nomenclatural changes. A substantial proportion of change is seemingly repetitive or haphazard rather than progressive or directional; for instance, taxa recognized at all taxonomic levels by Small (1933) and lumped or disregarded in the 1950s to 1980s have been resurrected on the basis of field and laboratory studies. Much taxonomic change involves subjective shifts from recognition of a taxon with the same circumscription

variously at specific, subspecific, and varietal levels, or variously at generic and subgeneric levels. The net result is that only a small proportion of taxa (24 percent) have traveled the years from 1933 to 2006 completely unscathed by changes in name, rank, or circumscription. Such volatility complicates the use of floristic information in research and conservation, and hinders communication with the public and other non-taxonomic scientists.

- 243 HODGE, CHRIS. University of Tennessee—Current Trends in Digital Library Development and the Implication for Botanical Collections.

Digital Libraries face several powerful challenges to their maturation. While digital content is expanding in format and volume at an ever-increasing rate, we are still limited in our ability to translate non-digital collections easily and economically and to integrate born-digital content transparently. Having invested scarce resources to build these collections, we must maximize their usefulness by allowing them to share data seamlessly and intelligently. This will require sophisticated mechanisms for granting permissions to individual users or groups of users; but harder still, it will require us to rethink deeply-held ideas about ownership and intellectual property. We should expect that objects in our digital collections will be re-used and repurposed – for presentations and publications, as teaching tools or as part of larger multimedia projects – and we must develop applications that allow objects to be manipulated easily and intuitively. We need to be able to customize delivery of objects, whether text, image, audio, video or multimedia, to reach the user, who may be accessing the collection via a website, a cellphone or a PDA, as well as accommodate any limitation the user may have (e.g., text-to-speech). Finally, there is the challenge of preserving and securing digital collections to the same extent as their non-digital antecedents. To meet all of these challenges together will require community-wide, standards-based open source solutions. Also, new developments in social software – rss syndication, tagging, reputation systems, etc. – suggest that expert communities and end-users may be organized to provide innovative solutions to some of these challenges.

- 244 GINZBARG, STEVE. University of Alabama—Customizing Darwin Core for plant data.

Darwin Core is a common standard adopted by participating collections which makes possible simultaneous searches of collection data from multiple collection databases over the web. It is currently being used by the Global Biodiversity Information Facility (GBIF) whose goal is to make data from all specimen collections accessible over the internet. Darwin Core is a simple one-size-fits-all-organisms exchange profile. The Botanical Extension consists of additional plant-specific elements which could be provided to a web portal dedicated to plant data. Descriptions of the Botanical Extension elements, as well as of the Darwin Core elements, are provided in a table which can be accessed from the symposium Collaborative web site. The descriptions of the Darwin Core elements are customized so that botanists will provide information more consistently for these elements to GBIF as well as to a plant portal. With your input I hope that this draft will come to reflect a consensus of the botanical community. Only we can tailor it to suit our needs.

- 245 LAPHAM, CHARLIE. Kentucky Native Plant Society—Legacy data and the Darwin Core.

Legacy data can be defined as data not intended to be provided in a standard format to a portal such as GBIF. Legacy data are often recorded on paper vouchers or magnetic media. The biggest single impediment to making legacy data compatible with GBIF is the Darwin Core Schema requirement of latitude and longitude in decimal degrees in order to map data. It is safe to assume that most historical vouchers will not have geospatial data

in this form and this one discrepancy puts most existing data into the legacy data category. There are other problems of this nature as well, making the process of bringing legacy data into a Darwin Core compliant form one of the major challenges associated with the development of internet networks of biological specimen data. This paper will discuss some of these issues and suggest some strategies SERNEC might use to address them.

- 246 AZPURUA-LINARES, FRANCIEL AND FRED RASCOE. Southern Appalachian Information Node (SAIN) of the National Biological Information Infrastructure (NBII)—NBII & SERNEC: Information Management for the Future.

The Southern Appalachian Information Node (SAIN) of the National Biological Information Infrastructure (NBII) is a public-private partnership working to provide the public with access to biological information and data. SAIN is working with regional, national and international organizations and entities to provide assistance and education related to information standards and management such as instruction on metadata creation standards and metadata creation tools (NBII input tool, Dublin Core, FGDC with Biological Extension) as well as support of established and new standards, protocols and tools for biodiversity information (Darwin Core, DIGIR, community terminology, and such).

- 247 TURMELLE, AMY S.¹, LOUISE C. ALLEN², CYNTHIA SCHMAEMAN³, MARY T. MENDONCA³, THOMAS H. KUNZ², AND GARY F. MCCRACKEN¹. ¹University of Tennessee, ²Boston University, ³Auburn University—Ecological effects of innate and adaptive immune function in Brazilian free-tailed bats (*Tadarida brasiliensis*).

This study examines both innate and adaptive immune function in wild populations of Brazilian free-tail bats in south-central Texas. With increasing numbers of bats inhabiting bridges and residential roosts, it is important to investigate the health of bats roosting in man-made and natural structures. Literature suggests that immune function can vary by age, sex, reproductive condition, and season. We test these hypotheses with Brazilian free-tail bats captured from four different sites (two caves and two bridges) by quantifying bactericidal ability of blood and an in vivo T cell response to an antigen challenge. Preliminary data suggest significant site and roost type variation in innate immunity, with bats at bridges showing lower bactericidal ability than bats in caves. Additionally, there was significant site and roost type variation for adaptive immune response, with bats from caves exhibiting a significantly greater T cell response than bridge-roosting bats. Sex, age, and reproductive condition were not consistent predictors of variation in bactericidal ability or T cell response within sites. These results will be discussed in the context of disease ecology.

- 248 TIBBELS¹, ANNIE E., ARNULFO MORENO², AND GARY F. MCCRACKEN¹. The University of Tennessee¹ and Instituto Tecnológico de Cd. Victoria²—Local Scale Population Structure of the Common Vampire Bat (*Desmodus rotundus*).

We examined mitochondrial genetic variation of common vampire bats (*Desmodus rotundus*) in western Tamaulipas, Mexico. The Sierra Madre Oriental Mountains, of Tamaulipas, are dissected by steep ridges and narrow valleys. Each valley is cut by an active creek, with farms and potential bat roosts distributed therein. Populations of *D. rotundus*, were sampled to characterize demographically significant units, as determined by the scale of genetic structure. We sequenced the hyper-variable mitochondrial control region from approximately 100 individuals, collected from 10 locales within Tamaulipas. *Desmodus rotundus* commonly forms polygynous mating groups of one adult male and a small number of females. Females typically remain in natal roosts, while juvenile males disperse to other colonies. Long distance dispersal in *D. rotundus* is uncommon. We

hypothesize that there will not be significant structure among populations within valleys, but significant matrilineal structure across populations of different valleys.

- 249 GREEN, J. JEFFREY GREEN AND MANUEL LEAL. Vanderbilt University—Fight, flight, or just hide: a quantified study of crypsis in the timber rattlesnake (*Crotalus horridus*).

Crypsis, or the ability to blend in with one's background, has been the focus of numerous studies on a variety of taxa. Although it is apparent many organisms resemble colors and patterns found within their environment, there is little empirical evidence in vertebrates quantifying the spectral quality of animals considered cryptic and their habitat. We evaluated the spectral light characteristics of the dorsal skin of the timber rattlesnake (*Crotalus horridus*), and compared it against the background of locations where snakes were previously found. Four different habitats, cedar glade, old field, cedar field, and mixed forest, were sampled in this study. The spectral characteristics of the snakes and habitats were analyzed using principal component analysis (PCA). Three extracted factors corresponding to spectral brightness, hue, and chroma were found to explain over 99% of the measured variance between snakes and habitats. We found no significant differences between habitats with respect to brightness, hue, and chroma. However, spectral patterns on the dorsum of the snakes varied such that the gray and cream colored regions perfectly matched the background while the black and rust colored regions were significantly different. Our findings suggest that a combination of background color matching and disruptive coloration can result in what is perceived as a cryptic pattern found on this snake. Furthermore, we suggest that a combination of background color matching and disruptive coloration might be common components of cryptic patterns in other vertebrate species.

- 250 HEINER, KRISTA AND MARK STANBACK. Davidson College—Nest Site Competition Among Secondary Cavity Nesters: Are Bluebirds Bullies?

The population size of many secondary-cavity nesting bird species is limited by the availability of nest sites. However, interspecific competition may play a more important role in the population dynamics of secondary cavity nesters (SCNs) than is commonly appreciated. In Davidson, North Carolina the four most common SCNs are, respectively, eastern bluebirds (*Sialia sialis*), Carolina chickadees (*Poecile carolinensis*), brown-headed nuthatches (*Sitta pusilla*), and tufted titmice (*Baeolophus bicolor*). To determine the role of interspecific competition in shaping the dynamics of this guild, we conducted a multi-level study. First we examined 5 years of nesting data from 250 nest boxes on local golf courses. We found that bluebirds usurp nests of smaller species significantly more often than vice versa. Next we provided a subset of the boxes at 4 golf courses with entrance holes too small for bluebirds. Compared to our 3 control courses, numbers of smaller SCNs increased in 2005 and 2006. In a final experiment, boxes were placed in pairs (large vs. small entrance hole, 10 m apart) in appropriate non-golf habitat. At a subset of the pairs we removed the box with the smaller entrance hole prior to breeding in 2006, creating competition between bluebirds and the smaller SCN for the remaining box. Compared to control sites, numbers of smaller SCN fell dramatically. Our results suggest that the large population increases enjoyed by eastern bluebirds in the last decades has been detrimental to smaller SCNs, and that competition for nest sites remains intense, even when nest boxes are abundant.

- 251 SAUTERER, ROGER Jacksonville State University, Jacksonville, AL—Incubation of frog embryos in waters and sediment extracts near the Monsanto plant (Anniston, AL) result in growth inhibition and abnormal behavior.

Waters and soils in Anniston, AL are contaminated by PCB-laden runoff from landfills at the local Monsanto plant. Despite clean-up efforts, soils, waters and the blood of local residents still have elevated levels of PCBs. In order to assess the effects of current PCB contamination on aquatic organisms, we are analyzing the development of the frog *Xenopus laevis* when exposed to control solutions, waters and aqueous sediment extracts from streams near the Monsanto site using both the standard Frog Embryo Teratogenesis Assay – *Xenopus* (FETAX) and extended incubations of frog embryos in control solutions and test samples. The standard FETAX assay shows subtle but significant growth inhibition in embryos exposed to contaminated waters and sediment extracts, though mortality and malformation rates are not affected. Because anuran embryos are relatively insensitive to the effects of PCBs and dioxins during the first five days of development and become more sensitive later, we are developing an extended modification of the FETAX assay where embryos are exposed to samples for two weeks or more. Preliminary results indicate embryos raised in contaminated Snow Creek water for 2 weeks have a higher mortality rate and more lethargic behavior compared to the controls. We are continuing extended incubation assays over the first 2-4 weeks of development and are developing a quantitative assay for embryonic movement.

- 252 ADAIR, BRIAN D. AND JAMES B. LAYZER. Tennessee Technological University–Factors associated with the localized distribution of adult and juvenile freshwater mussels (Bivalvia: Unionoidea).

Comparative studies on the ecology of adult and juvenile freshwater mussels are few. Because of their small size, juvenile mussels are difficult to locate, and even at sites where reproduction and recruitment appear to be strong, juveniles occur in low densities. For this project, the local distribution of freshwater mussels was studied at a site where recruitment was occurring. Ten evenly-spaced parallel transects were established within a 90-meter reach of the Duck River in Marshall County, Tennessee. Along each transect, ten sampling points were marked at 2.7-m intervals. At each point, microhabitat variables were measured, and mussels were collected from three 0.25 m² quadrats randomly placed within the surrounding 2.25-m² area. Regression analysis indicated that both adult and juvenile mussel densities were related ($p < 0.05$) to interstitial water temperature (adult R² = 0.94; juvenile R² = 0.78) and shear stress (adult R² = 0.58; juvenile R² = 0.50). Adult density was also related to substrate roughness (R² = 0.64). The best predictors of juvenile mussel occurrence determined from stepwise logistic regression were distance from the left ascending bank, substrate roughness and substrate permeability, while the best predictors of adult occurrence were depth, substrate roughness and shear stress.

- 253 FELIX, ZACHARY¹, YONG WANG¹, AND CALLIE JO SCHWEITZER². Alabama A&M University¹ and USDA Forest Service, Southern Research Station²–Movement patterns of eastern box turtles, *Terrapene carolina*, in forest stands managed for timber.

The amount and manner in which an animal moves is affected by a number of factors. These factors can in turn be altered as a result of modifications to the animal's habitat. Accordingly, we hypothesized that canopy tree removal associated with shelterwood cuts may lead to changes in characteristics of movements made by eastern box turtles. We tested this hypothesis by radio tracking 8 box turtles (5 females, 3 males) in control stands and 10 turtles (6 females, 4 males) in stands which had been randomly chosen to retain between 25 and 50% of their basal area in a commercial timber harvest. The study took place on the Cumberland Plateau in northeast Alabama. Preliminary analyses show that turtles tend to have larger home ranges (minimum convex polygon) on uncut plots when compared to cut plots. Box turtles on cut plots tend towards more linearly shaped home ranges than those on uncut plots. Data will also be presented on average distance moved between locations in the two stand types. These data suggest that turtles change the

amount and manner in which they move in response to structural changes to their habitat. It is unknown what effects, if any, these changes have on energetics and/or survival of the species.

- 254 BURTON, ELIZABETH C., MATTHEW J. GRAY AND A. CHANDLER SCHMUTZER. University of Tennessee—Influences of cattle on Cumberland Plateau amphibians in a predator-rich environment.

Amphibians are declining globally in response to anthropogenic stressors. Agricultural cultivation and deforestation have been shown to negatively influence amphibian populations; however, few studies have quantified influences of cattle grazing in wetlands. A natural experiment existed at the University of Tennessee Plateau Research and Education Center near Crossville, Tennessee, where 4 wetlands have been exposed to cattle grazing for >10 years and 4 additional wetlands in close proximity have never had direct cattle access. Therefore, we measured total and species-specific relative abundances of resident amphibians at each wetland from March–August 2005 using mark-recapture data from pitfall traps. Abundances were compared between cattle-access treatments ($n = 4$ wetlands/treatment) using 2-sample t -tests and the SAS® system. No differences in total relative abundance (all species combined) were detected ($P=0.59$) between treatments; however, this was a consequence of one cattle-access wetland, where relative abundance was 8X and 2X greater than all other grazed and non-grazed wetlands, respectively. Inflated abundance at this wetland likely was a result of fewer ($P<0.001$) aquatic predators compared to the other wetlands. When this outlying datum was removed, mean daily and total capture of amphibians was greater ($P<0.03$) at wetlands without cattle than in cattle-access wetlands. Species-specific tests indicated that metamorph green frogs (*Rana clamitans*) influenced treatment trends; no statistical differences were detected ($P>0.13$) for other species and age classes. Our results suggest that cattle may negatively influence amphibians, although this effect may be species and age dependent, and affected by aquatic predators.

- 255 CHAN, FLORENCE, AND YONG WANG. Alabama A&M University—Herpetofaunal community at the Walls of Jericho and Forever Wild properties in Northern Alabama.

Recent purchases of The Walls of Jericho and Forever Wild tracts by the state of Alabama call for the need of a biological monitoring program to establish an appropriate management strategy for the area. A randomized stratification was used to select points based on landform and exposure to the sun, where surveys for amphibian and reptile species were to be conducted. A total of 176 points were selected and the first 88 points were surveyed in the spring 2005 and resurveyed in fall 2005. The remaining points will be surveyed in the spring and fall of 2006. Distance sampling was used and two observers walked line transects. At each point, environmental conditions were recorded. A random bearing was chosen and the 100 meter measuring tape walked out, before returning to the start point to search natural cover objects such as rocks, logs and litter intensively. When an individual was found, its life stage, sex, substrate found in, and the distance to the line were recorded. Eight transects consisting of two squares of 100 meters on each side results in a figure eight pattern of sampling with the random point as the node. The first spring, 680 individuals were encountered comprising 13 amphibians and 17 reptile species. An additional, seven species were either heard during the survey or were found doing random searching of the area. The Green Salamander, *Aneides aeneus*, a protected species was found. This study will help land managers to better administer policies that will protect priority amphibian and reptile species.

- 256 FISHER, ASHLEY R.¹, W. ROBERT GORDON² and THOMAS K. PAULEY¹. Marshall University¹ and West Liberty State College²—The presence of *Chrysemys picta* intergrades in the eastern panhandle of West Virginia.

During the last 5 years, biologists in West Virginia have been examining the potential range of painted turtle intergrades in the state. Eastern Painted Turtles, *Chrysemys p. picta*, have been documented east of the Allegheny Front while Midland Painted Turtles, *Chrysemys p. marginata*, are mainly west of the front. It has been theorized by biologists that turtles west of the front are assemblages of the Ohio River drainage and those east of the front are in the Potomac River drainage. This distribution theory would be logical since the Allegheny Mountains serve as a barrier separating these 2 river systems. Studies of turtle assemblages in the eastern panhandle of West Virginia in 2005, resulted in the observation of 149 *Chrysemys picta*. Of these turtles, 57% were *C. p. picta*, 41% intergrades, and 2% *C. p. marginata*. Our study suggests that a zone of intergradation lies east of the Allegheny Front and redefines the distribution range for *C. p. picta* and *C. p. marginata* in West Virginia.

- 257 GLORIOSO, B.M., ELIZABETH L. YOUNG AND VINCENT A. COBB. Middle Tennessee State University—Population ecology of *Sternotherus odoratus* at Reelfoot Lake, Tennessee.

In a roadside slough adjacent to Reelfoot Lake, a population of stinkpots, *Sternotherus odoratus*, has been sampled periodically from September 2004 to November 2005 using deep-water crawfish nets baited with chicken. This novel technique, in 31 samplings with average duration of 7.5 hours, has captured 861 stinkpots, comprising 655 individuals. The sex ratio is male-biased at 1.44 males to every female. However, the individual recapture sex ratio is female biased at 1 male for every 1.15 females. Although violating an assumption of the model, Schnabel estimates 1413 individuals in the population, giving a population density estimate of 1596 individuals per hectare. The mean mass of individuals captured is 103 grams, yielding a biomass estimate of 164.4 kg per hectare. The density and biomass estimates from this study exceed all previous studies of stinkpots. Although uncertain, the possibility exists that previous studies have underestimated stinkpot populations, and this study, with an efficient capture technique, is more representative of most natural populations of stinkpots.

- 258 BORDEN, JOEL A. AND DAVID H. NELSON. University of South Alabama—A comparison of herpetofaunal communities between two upland mosaic habitats bordering the Mobile-Tensaw Delta.

A herpetofaunal field study was conducted to address how habitat variation influences species diversity, abundance, and distribution in an upland coastal plain ecosystem. The areas chosen for study were two diverse upland sites bordering the Mobile-Tensaw Delta in southwestern Alabama, that were sampled from February to December 2005. The objectives were to examine community structure of amphibians and reptiles (with respect to habitat type) on state-managed lands in Baldwin and Mobile Counties. Ten habitat types were selected, based on elevation, dominant vegetation, age of stand, percent ground cover, percent canopy cover, soil type, and hydrology. The Baldwin County site is dominated by a 20-year old, former loblolly pine plantation with elevations ranging from 7-30 meters. The Mobile County site is characterized by oak flatwoods interspersed with long-leaf pine between 60 and 80 years old, at an elevation of 3 meters. Each habitat type was sampled by a single drift fence array composed of three arms with six terrestrial funnels and three 19-liter pitfalls. Also included in each array were twelve cryptozoan covers, five PVC tubes (treefrog refugia), visual transects, anuran call monitoring, and hand captures. Twenty-one species of amphibians (N=2447) and thirty-one species of reptiles (N=916) were encountered. The results of the herpetofaunal community

assessment suggest that habitat diversity and a variety of ecotones drive amphibian and reptile abundance and diversity along the coastal plain ecosystem of southwest Alabama.

- 259 LOWERY, ADAM, DANIEL KLUCZNIK, AND JONATHAN AKIN. Northwestern State University of Louisiana—Symbiosis between algae and *Ambystoma maculatum* salamanders.

The presence of algae in some of the egg masses laid by *Ambystoma maculatum* is well known but ecologists have differed over whether the symbiotic interaction is commensalistic, mutualistic, or even parasitic. In this study, we identified which different species of algae colonized *Ambystoma* egg masses from different Louisiana vernal pools and followed larval development in alga-colonized versus alga-free masses. We found that larvae development was both quicker and more successful in algal-colonized masses than algal-free masses. In addition, water quality was different in algal-colonized masses than algal-free masses. It seems likely that this symbiotic relationship is mutualistic.

- 260 NIEMILLER, M.L., AND BRIAN T. MILLER. Middle Tennessee State University—Phylogenetics of the Tennessee Cave Salamander (*Gyrinophilus palleucus*) complex.

The Tennessee Cave Salamander complex (*Gyrinophilus palleucus* and *G. gulolineatus*) includes aquatic, paedomorphic, plethodontid salamanders endemic to subterranean waters of central and eastern Tennessee, northern Alabama, and northwest Georgia. Two species, one with two subspecies, and an undescribed form from the Central Basin, are currently recognized based on morphological variation in eye size, pigmentation, modal number of trunk vertebrae, and body size. However, little work has been conducted on the phylogenetics of the complex. A phylogenetic analysis of the Tennessee Cave Salamander complex and other cave-dwelling *Gyrinophilus* was conducted using a portion of the mitochondrial 12S rDNA gene. Neighbor joining, maximum parsimony, and maximum likelihood analyses were conducted on the 851 base-pair 12S rDNA data set that included 69 individuals from 27 localities. Fifteen distinct *Gyrinophilus* haplotypes were observed and all genetic variation occurred among populations rather than within. While the 12S gene is rather conservative in *Gyrinophilus*, results indicate that *G. gulolineatus* may be paraphyletic, while *G. p. necturoides* is the sister taxon to *G. porphyriticus* populations from the Eastern Highland Rim in Tennessee. Little variation exists among several populations including those of *G. p. palleucus*, populations from the Western Escarpment of the Cumberland Plateau, populations along the Collins River in Warren County, and populations along the Duck River in Marshall and Maury County in Tennessee.

- 261 ROMINE, MICHAEL, TYLER POOLE AND JONATHAN AKIN. Northwestern State University of Louisiana—Energetic costs associated with behavioral displays in the ground skink, *Scincella lateralis*.

A basic assumption of the behavioral ecology of displays is that there are costs associated with producing the signal. In contests over food, male ground skink lizards, males sometimes engage in exaggerated displays in which males undulate their bodies while in close proximity to each other. Typically, the longer a male undulates relative to other male, the more likely he is to win the encounter. In this study, we used respirometry to determine relative oxygen consumption and CO₂ production levels in undulating versus non-undulating animals. We found that this display does indeed cost the lizards energy and that long duration displays can only be produced by lizards with sufficient energy reserves. Thus, the display behavior appears to be an honest signal of resource holding potential.

- 262 PLACYK, JOHN S., JR., Dept. of Ecology & Evolutionary Biology, University of Tennessee, Knoxville—Variation in life history traits and population demographics of insular and mainland populations of the common gartersnake (*Thamnophis sirtalis*).

The common gartersnake (*Thamnophis sirtalis*) is the most widespread snake in North America, occurring in nearly every natural habitat found throughout its range. While the reproductive characteristics of *T. sirtalis* populations are known to vary considerably across its vast range, little data on such characteristics from populations that occur relatively close to each other are available. This research utilized island and mainland populations of Michigan gartersnakes that are located relatively close to each other, but that differ in various characteristics (e.g., population density, predator composition, prey availability). In addition to variable habitat characteristics that may drive variation in reproductive characteristics, these populations were also utilized because their underlying genetics were recently revealed. As a result, patterns of variation resulting from historical processes could be detected and disseminated from patterns resulting from current environmental conditions. Despite the underlying genetics of the populations sampled and the proximity of the populations to each other, reproductive characteristics such as litter size and neonate mass varied considerably between populations corresponding strongly with current environmental characteristics. The data from this work indicate that environmental factors, especially, play a substantial role in the reproductive characteristics exhibited by gartersnake populations, but that the influence of the underlying genetics of a population may also be important and should be taken into consideration.

- 263 SLAPCINSKY¹, JODI L., DORIA R. GORDON¹ AND ERIC MENGES². The Nature Conservancy, Gainesville, Florida¹ and Archbold Biological Station², Lake Placid, Florida—Responses of rare plant species to fire across Florida's fire-adapted communities.

Lightning- and human-ignited fires have shaped many of Florida's natural communities. Persistence in these habitats requires adaptation to high temperatures and tissue loss or avoidance of these conditions through survival in unburned patches. Limited distribution of many rare species in increasingly fragmented habitats decreases the probability that chance avoidance will ensure long-term viability. The Nature Conservancy and Archbold Biological Station has monitored 20 rare plant species for up to 14 years in sandhill, scrub, and pine rockland communities across Florida. Across a number of life history variables, including cover, density, frequency, flowering, and recruitment, 60% of these species responded positively and 40% responded neutrally to fire. No species showed population declines following fire. Strategies for tolerating fire varied from adult mortality coupled with high seedling recruitment following fire to high survival and stimulated seed production. Timing of the response may be delayed for several years post-fire, suggesting that monitoring has been insufficiently long for understanding of population dynamics in some species.

- 264 WALL, WADE A., THOMAS R. WENTWORTH AND WILLIAM A. HOFFMANN. North Carolina State University—Vegetation and soils of a North Carolina Coastal Plain wet savanna.

Pine savannas, once widespread on the southeastern Coastal Plain, have been reduced by fire suppression, logging, and development. Wet pine savannas on fine-textured soils are especially rare, best exemplified in North Carolina by the B.W. Wells Savannah in northern Pender County. A large, privately-owned tract adjacent to the Wells Savannah also supports many rare and endemic Coastal Plain species. Fire suppression on this tract resulted in encroachment of woody vegetation, but logging in the late 1990's removed

most of the canopy. This undeveloped tract now has a heterogeneous vegetation cover, with some areas containing pocosin-like vegetation and others resembling savanna. Through an agreement with the landowner, we have had an opportunity to inventory a rarely-studied ecosystem prior to an experimental restoration using prescribed fire. Using the Carolina Vegetation Survey protocol, we sampled 56 100 m² plots, documenting soil properties and recording cover at the plot level and presence at multiple scales for vascular flora. We present results of preliminary analyses of the soil and vegetation data using multivariate techniques. We document pre-treatment conditions for long-term study of the effects of prescribed fire on vegetation dynamics at the physiological, population, and community levels in a wet pine savanna.

- 265 LU^{1,2}, ZHI-JUN AND KE-PING MA¹. Chinese Academy of Sciences¹, University of Memphis²—Croftonweed (*Eupatorium adenophorum*) Sweeping Southwest China along Roads and Streams.

Roads and streams are noted as important conduits for spread of invasive species. However, is it true for *E. adenophorum*, which was native to Mexico and the most dangerous exotic weed in China, especially in southwest China? Does the same invasion pattern exist and what factors can explain these patterns? We established six transects in Huili County, Sichuan Province to detect the invasion pattern of this plant along roads and streams. The results demonstrated that the distance from the road and stream had overall significant effects on the cover, abundance and average height of *E. adenophorum*. However, after compensation forenvironmental factors, distance from road significantly affected the cluster number of this plant. Instead, native plant species cover was significantly correlated with *E. adenophorum* invasion. After compensation for environmental factors, the distance from the stream was still significantly correlated with the invasive plant presence, but not cover, abundance and cluster number, which were significantly affected by elevation and native species cover. There was no overall significant effect of native species richness on the invasion of this plant along the road and stream. These findings suggested that roads and streams were major conduits for the spread of *E. adenophorum* in southwest China. Native species cover was the limiting factor for invasion pattern of this plant and high native species cover can enhance the resistance of communities along roads and streams. In the management and control of *E. adenophorum*, habitats along roads and streams should be concentrated on as main channels. Furthermore, to restore natural plant communities in invaded regions, fast-growing native plants are preferred to enhance the community resistance to invasion of *E. adenophorum*.

- 266 CARTER, ROBERT AND BRENT WOMACK. Jacksonville State University—Landscape scale ecosystem classification in the Talladega Mountains of Alabama.

Landscape scale ecosystems in the Appalachian region of Alabama were analyzed through multivariate techniques using vegetation, soil, and landform variables. Five communities were identified including chestnut oak-oak leaf-hydrangea-wild yam, loblolly pine-American hornbeam-hayscented fern, longleaf pine-partridge pea-legume-, longleaf pine-dwarf huckleberry-Elliott's blustem, and longleaf pine-shortleaf pine-muscadine grape. The diagnostic environmental variables included landform index, A-horizon depth, A-horizon Mg, B-horizon Ca, B-horizon Mg, B-horizon P, and slope.

- 267 FLEMING, MIRANDA M., JON M. STUCKY AND CAVELL BROWNIE. North Carolina State University—Interactive effects and relative importance of neighboring vegetation and soil wetness on the growth and survival of *Solidago verna*, spring-flowering goldenrod, in the North Carolina Coastal Plain.

Solidago verna (spring-flowering goldenrod) is a rare endemic primarily of frequently burned longleaf pine flatwoods in the Carolinas, listed as threatened in North Carolina and as a federal species of concern. Continued threats to the species are fire suppression and habitat destruction, including planned highway construction through the largest known population. Plants in this threatened population were transplanted into study plots on seven Coastal Plain soils varying in wetness. Full vegetation and reduced vegetation treatments were applied to test the effects of plant interactions. Soil wetness was the most important factor affecting transplant survival. *S. verna* can not survive in areas where ponding or flooding occur. Neighbor effects on survival differed significantly between soils. Both increasing soil wetness and the presence of neighboring vegetation negatively affected transplant growth, however, most of the decrease in transplant mass was attributed to other environmental factors, possibly shading from the tree canopy or transplanting stress. For successful mitigation transplanting, these authors recommend establishing receptor sites on the Lenoir soil series and burning those sites every 1-3 years.

- 268 MARIK, JULIE E. AND CLAUDIA L. JOLLS. East Carolina University—Seed mass variation among and within populations of *Amaranthus pumilus*, seabeach amaranth, a federally threatened coastal annual.

In theory, seed size for a given species should remain constant within a population, stabilized by the benefit of increased size at the expense of number of offspring produced. Empirical evidence, however, suggests seed mass varies among populations and even individuals within a population. This variation is often attributed to environmental factors, but the possibility that genetic variation also makes a contribution should not be overlooked. *Amaranthus pumilus*, seabeach amaranth, is a rare coastal annual indigenous to the eastern United States. When compared with closely related members of the same genus, *A. pumilus* produces relatively larger seeds. This study looked at variation among and within populations of *A. pumilus*. Seeds measured were from the National Collection of Endangered Plants housed at the North Carolina Botanical Gardens. The collection includes specimens from several years, states, sites and individuals. Over 900 seeds from approximately 10,000 contained in the collection were massed to 0.001 mg using a CAHN microbalance. Average seed mass by state was (mean \pm SE) 3.176 ± 0.0388 mg for New Jersey, 2.695 ± 0.0198 mg for North Carolina, and 2.776 ± 0.0431 mg for South Carolina. Significant differences in seed mass also were found among plants within a site and among sites within a year. Further study is needed to determine the consequences of seed size and variation on germination and seedling survival, particularly for the conservation and management of this taxon.

- 269 ROCK, JANET¹, DANIEL GAGNON² AND PATRICK NANTEL³. Great Smoky Mountains National Park, Gatlinburg, TN¹, Groupe de recherche en écologie forestière interuniversitaire, Montréal, QC² and Parks Canada, Hull, QC³—Wild American ginseng populations in the southern Appalachians may be negatively affected by climate change.

Demographic analysis was conducted during 4 years in 2 populations (1998-2001) and 2 to 3 years in 4 populations (1999-2001) of *Panax quinquefolius* in Great Smoky Mountains National Park, yielding 13 transition matrices. Populations were comprised of between 90 to 200 plants, and occurred from 575 to 1280 m elevation. Objectives were to characterize demography, evaluate impacts of harvesting, and assess minimum viable population (MVP) size. Dormancy of large plants is confirmed for the first time in ginseng, with 8% (average) of all plants entering dormancy in any year, and a maximum of 29% of 4-leaved plants in one population in 2000. Most dormant plants emerged after 1 year of dormancy (with a decrease in size), but 12% remained dormant for 2 years. Seed production was very low, declining from 1998 to 2000, averaging 10 seeds per 4-leaved plants. Population

growth rates calculated from the matrices vary from 0.856 to 1.076. Stochastic projections indicate that these populations are barely maintaining themselves and cannot tolerate any harvesting. The determined MVP size of 510 plants, linked to low mean population growth rate, is larger than most existing populations, within or outside the park. Dormancy of large plants, small seed crops and low population growth rates appear related to droughts during 3 of 4 years of the study. Continued legal harvest pressure in the US, increasing deer browse pressure in many areas, combined with likely climate change effects, will lead to the decline of American ginseng populations throughout the range of the species.

- 270 WALKER, GARY L. Appalachian State University—Cliff-face ecology in the Southern Appalachians.

Cliff faces may support some of the most extensive undisturbed old-growth forests for eastern North America. Studies in Canada have shown that cliff faces along the Niagara Escarpment possess relatively similar plant communities extending for hundreds of miles. Cliff systems in the Blue Ridge, Ridge and Valley and Cumberland Plateau physiographic regions of the Southern Appalachians have been surveyed for vegetational communities. Ancient trees, glacial relict plant species with high levels of genetic variability, complex community structures and species of lichens previously undescribed have been observed in the course of these studies. Heterogeneity among cliff-system plant communities was observed within and among these physiographic regions. This is perhaps owing to the unglaciated, ancient ages of the systems associated with cliffs in the Southern Appalachians. Rock climbing poses the first real human-induced disturbance threat to these ancient communities; its observed impacts on vegetational structure will be discussed.

- 271 BALLINGER, DAVID , GARY L. WALKER AND CHRISTIAN PETERSON. Appalachian State University—A vegetational survey of an unclimbed cliff system at White Rocks, Cumberland Gap National Historic Park.

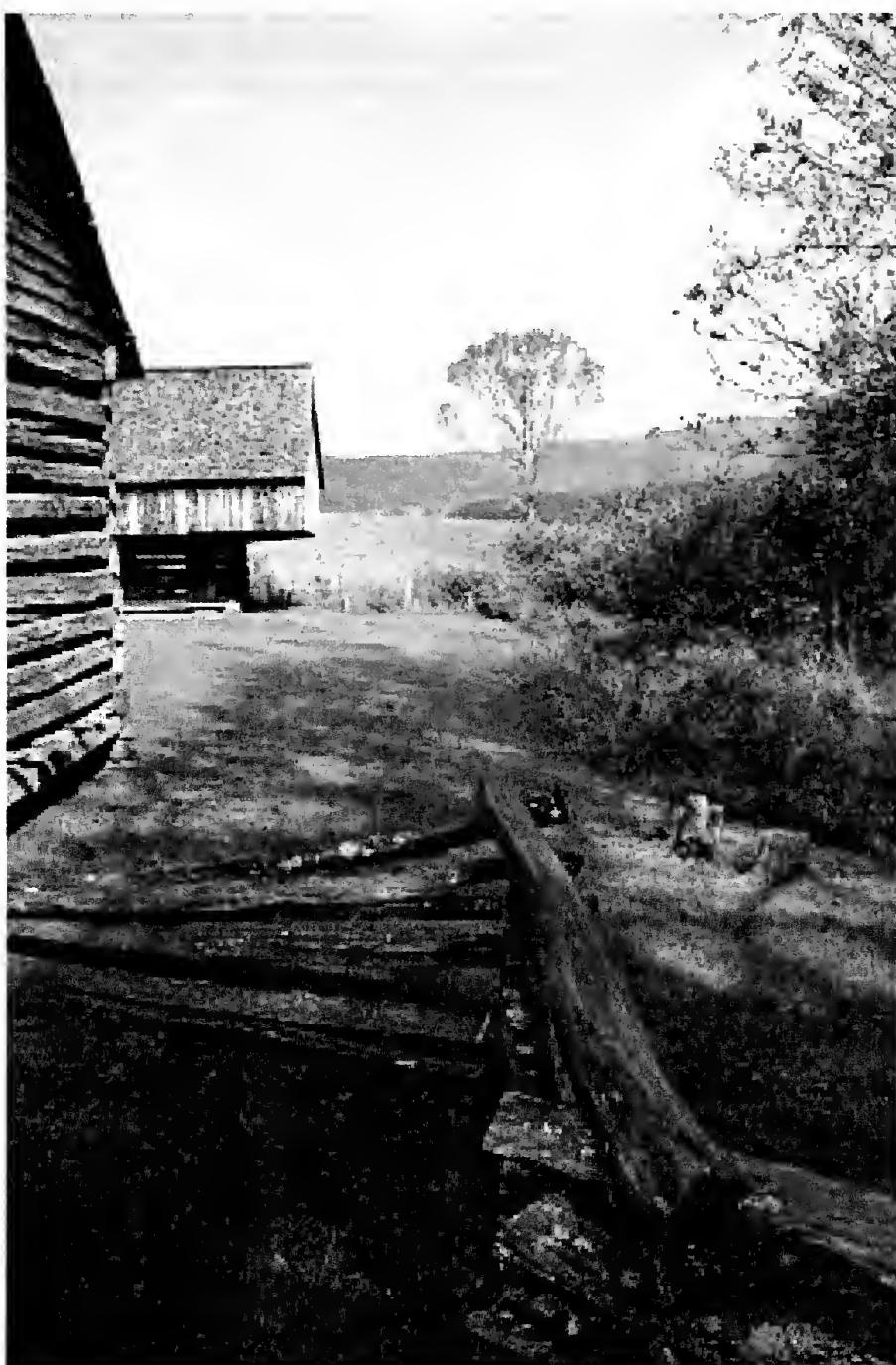
A vegetational survey of the White Rocks cliff system, located in the Cumberland Gap National Historical Park, was conducted from June to November of 2005. Vascular plants, mosses, and lichens were surveyed on the cliff top, cliff face, and talus using 1m² plots spaced evenly along randomly located vertical transects. Physical characteristics including position on the cliff, slope, aspect, and plant and lichen species percent coverage were recorded for each plot. In addition, microhabitat form was recorded for each plot, and included ledges, cracks, pockets, scoops, and dihedrals. Transect and plot locations with respective biotic and abiotic features were used to construct a GIS data base of the cliff system to assist in recreational management considerations, with a focus on rock climbing access. Biotic and abiotic factors were analyzed with multivariate statistics to determine physical factors which contribute to vegetational community structure of the cliff edge, cliff face and talus. This project was funded by the National Park Service in conjunction with the Southern Appalachian Cooperative Ecosystem Study Unit.

- 272 STALTER, R.¹, ANNA JUNG¹, ANN STAROSTA¹, SAADIA SHALLALAH¹, JOHN BADEN², M.D. BYER³¹Department of Biological Sciences, St. John's University, Jamaica, New York, USA. ²U.S. Corps of Engineers, Wilmington, North Carolina, USA. ³Division of Natural Resources, Gateway National Recreation Area, National Park Service, Staten Island, New York, USA—Effect of wrack accumulation on salt marsh vegetation in South Carolina salt marsh.

The objective of the present study was to test the effect of wrack cover on vascular plant species at four sites in a South Carolina salt marsh. In March, 2004, four arrays were established in different types of salt marsh vegetation. The vegetation was covered with 15-20cm of wrack secured in place with netting, in an attempt to duplicate the natural

deposition of wrack on the marsh by tides and storms. A control plot in each array was left uncovered. The wrack was removed from one plot in each array at one, two, four and six month intervals. One month of wrack coverage had little effect on either density or standing crop (recorded six months after initial coverage) of the principal marsh species, *Spartina alterniflora*, *S. patens*, *Distichlis spicata*, *Salicornia* spp., *Limonium carolinianum*, *Borrichia frutescens*, and *Sporobolus virginicus*. Above-ground growth of the aforementioned species was strongly inhibited after two months of continual coverage, and killed or extremely inhibited after six months. Recovery of salt marsh species is exclusively by asexual reproduction on the edge of the exposed plots. No seedlings have been observed in any of the experimental plots during 2004 and 2005 growing season. Recovery of the original vegetation in wrack covered (and removed) areas of the salt marsh may be a slow process at this salt marsh.

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Cades Cove, Great Smoky Mountains National Park.
Photo by Marilyn Caponetti, Knoxville.

ABSTRACTS – POSTERS**Animal Biology and Ecology**

- P1 CHESH, ADRIAN¹, LUIS A. EBENSPERGER², AND LOREN HAYES¹. University of Louisiana at Monroe¹ and Pontificia Universidad Católica de Chile²—Ecological correlates of degu (*Octodon degus*) sociality in central Chile.

Developing a better understanding of the ecological correlates of sociality i.e., the tendency for individuals to live in groups, is a major goal of behavioral ecology. To date, there have been few studies evaluating the relationship between intraspecific habitat variation and sociality in rodents. In this study, a number of possible ecological correlates to group living were assessed within a population of degus (*Octodon degus*) in central Chile. Between June and August 2005, we determined the composition and size of N = 11 social groups. Group sizes were determined through a combination of radio-telemetry, live trapping at degu burrows, and behavioral observations. Between August and September 2005, we then measured soil hardness, food availability (monocot and dicot biomass), and distance to nearest shrub at burrow systems occupied by each group. Our preliminary analyses indicated that neither soil hardness nor food availability were significant predictors of degu group size. However, we did observe a weak correlation between group size and distance to nearest shrub with group size increasing with increasing distance from the nearest shrub. A likely explanation of this result is the “many eyes” hypothesis which posits that individuals form larger groups in open habitats to enhance predator detection. This result supports previous observations in that degus in larger groups more rapidly detect an approaching predator than degus in smaller groups. Together, these results suggest that group-living is critical to predator detection in areas without overhead vegetative cover.

- P2 FORONDA, JOSH AND TERRY RICHARDSON. University of North Alabama—Foraging behavior of the Caribbean spiny lobster, *Panulirus argus*.

Although much is known about the biology of the spiny lobster, *Panulirus argus*, little is known about this organism's feeding ecology, especially for juveniles. Because spiny lobster are known to feed on dwarf cerithid snails (*Cerithium lutosum*), snails were collected and divided into small (<9.5 mm shell length) and large (>9.5 mm SL) size categories. Nine juvenile lobster (24.6 to 40.9 mm carapace length) and two adults (78.6 and 79.4 mm CL) were placed into eleven holding tanks. The lobster were starved for two days prior to the experiment. The lobster were next given equal portions of small and large snails. The lobsters were monitored for a 48-hour period at regular intervals and snails eaten by the lobster were replaced with snails of the same size. Analysis of the percentage of snails of each size category eaten indicates that more small snails than large were eaten by the lobster (i.e., snail treatment, p=0.0021). However, there was no difference in percentages of snails eaten by the different lobster size classes (lobster treatment, p=0.8322) and different sized lobster showed no snail size preference (snail x lobster interaction, p=0.4652). Within the sizes of lobster studied, juveniles and adults show no difference in snail size preference, i.e., small snails are preferred by all lobster size classes. This suggests that the effort required, risk of mandibular damage or both associated with eating larger snails makes them less profitable than smaller snails and therefore less preferred.

- P3 HENNINGS, KATHLEEN, ADRIAN CHESH AND LOREN HAYES. University of Louisiana at Monroe—Testing the intrauterine hypothesis in a wild population of house mice (*Mus musculus*).

In litter bearing species, an individual's position in the uterine horn i.e., intrauterine position (IUP), may affect adult physiology, behavior, and reproduction. Females located next to two males (2M) are masculinized due to exposure to testosterone, exhibiting greater levels of aggression, larger home ranges, and increased competitive ability than females situated next to no males (0M) *in utero*. In some species, the distance between

the anus and genitals i.e., ano-genital distance (AGD) is used to predict an individual's IUP. Females with short AGD measurements are classified as 0M and females with long AGDs are classified as 2M. The IUP hypothesis predicts that 2M females are most abundant at high population density whereas 0M females are most abundant at low population density. We are testing this hypothesis by assessing the AGDs of female house mice (*Mus musculus*) during monthly live-trapping at a farm in northeast Louisiana. We expect more 2M females at high animal density than at low animal density. Since masculinized females produce more male offspring, we also expect more male pups at high animal density. In contrast, we expect more 0M females and female pups to be produced at low animal density. Preliminary data indicate that 2M and 0M females are similar in abundance with 1M individuals (i.e., females situated next to one male *in utero*), the most abundant phenotype. Ultimately, we will assess the relationship between IUP and population density. Understanding this relationship may improve our understanding of rodent population cycling.

P4 HEINER, KRISTA AND MARK STANBACK. Davidson College—Nest Site Competition Among Secondary Cavity Nesters: Are Bluebirds Bullies?

The population size of many secondary-cavity nesting bird species is limited by the availability of nest sites. However, interspecific competition may play a more important role in the population dynamics of secondary cavity nesters (SCNs) than is commonly appreciated. In Davidson, North Carolina the four most common SCNs are, respectively, eastern bluebirds (*Sialia sialis*), Carolina chickadees (*Poecile carolinensis*), brown-headed nuthatches (*Sitta pusilla*), and tufted titmice (*Baeolophus bicolor*). To determine the role of interspecific competition in shaping the dynamics of this guild, we conducted a multi-level study. First we examined 5 years of nesting data from 250 nest boxes on local golf courses. We found that bluebirds usurp nests of smaller species significantly more often than vice versa. Next we provided a subset of the boxes at 4 golf courses with entrance holes too small for bluebirds. Compared to our 3 control courses, numbers of smaller SCNs increased in 2005 and 2006. In a final experiment, boxes were placed in pairs (large vs. small entrance hole, 10 m apart) in appropriate non-golf habitat. At a subset of the pairs we removed the box with the smaller entrance hole prior to breeding in 2006, creating competition between bluebirds and the smaller SCN for the remaining box. Compared to control sites, numbers of smaller SCN fell dramatically. Our results suggest that the large population increases enjoyed by eastern bluebirds in the last decades has been detrimental to smaller SCNs, and that competition for nest sites remains intense, even when nest boxes are abundant.

P5 HUTCHENS, JOHN J., KEITH WALTERS, AZURE BEVINGTON AND LAUREN GREENFIELD. Coastal Carolina University—Productivity of two common gastropods in a South Carolina salt marsh.

We studied the productivity of two common gastropods, *Littoraria irrorata* and *Melampus bidentatus*, with respect to vegetation zones in a salt marsh behind Waites Island, SC from January to December 2004. Abundance and biomass of *Littoraria* was highest (mean = 111/m² and 6,850 mg AFDM/m², respectively) in the mid marsh (i.e., short *Spartina alterniflora*). Abundance of *Littoraria* was similar between the low (i.e., tall *Spartina alterniflora*; mean = 46/m²) and high marsh (i.e., mixed vegetation such as *Spartina patens*, *Juncus roemerianus*, and *Borrichia frutescens*; mean = 43/m²), but biomass was higher in the low marsh (mean = 3,371 mg AFDM/m² and 1,790 mg AFDM/m², respectively). *Melampus* was almost exclusively found in the high marsh (mean = 65/m² and 109 mg AFDM/m²). Although the abundance of the two species was relatively similar in the high marsh where they overlapped, mean biomass of *Littoraria* was 16 times higher than *Melampus*. *Melampus* abundance and biomass peaked in late summer, whereas *Littoraria* showed no clear seasonal peaks due to overlapping cohorts. Growth rates of marked *Littoraria* were highest in the mid marsh and lowest in the low marsh. Highest levels of abundance, biomass, and growth rates of *Littoraria* in the mid marsh corresponded to highest stem densities of *Spartina alterniflora*. High stem densities may

provide increased food resources for the snails, as well as afford protection from predators.

P6 MERCADANTE, AUSTIN AND MARK STANBACK. Davidson College—Effects of housing density on eastern bluebird (*Sialia sialis*) reproductive parameters

As natural habitats are transformed into suburban sprawl, many animal species experience demographic declines. Although some species such as eastern bluebirds (*Sialia sialis*) can breed successfully in developed habitat, prior research has demonstrated that rural bluebirds outperform suburban bluebirds in a variety of reproductive parameters. Here we examine whether housing density on suburban golf courses is predictive of reproductive performance on those courses. To do this, we analyzed reproductive data from eastern bluebird nests on seven golf courses near Davidson, NC from the years 1999-2005. Using housing data obtained from county websites (particularly the POLARIS program), we were able to calculate the number of houses on each fairway of each course in each of the 7 years of the study. Some of these courses have experienced major increases in housing density over these years; others experienced little additional development during this time. Using general linear models, we were able to control for annual variation, site effects, and nest date effects to determine if housing density impacted the onset of breeding in the spring, clutch size, brood size, and chick condition.

P7 MOYE, VALERIE AND JONATHAN EVANS. University of the South—Habitat suitability analysis for mountain lions on the southern Cumberland Plateau.

Since the 1940's the mountain lion has been extirpated from the eastern United States due to exhaustive hunting, habitat loss, and declining prey populations. Recently, however, evidence suggests that existing mountain lion populations are expanding and recolonizing sites where they have been absent for nearly a century. The southern Cumberland Plateau, part of the historic home ranges for the extirpated Florida panther (*Puma concolor coryi*) and Eastern Cougar (*Puma concolor cougar*), lies at the Tennessee/Alabama border and contains some of the largest remaining tracts of native forests in the southeast. Using ArcGIS 9 we examined several landscape and habitat characteristics including road density, human population density, deer density, land cover type, patch density, and contagion covering seven counties in Tennessee and three counties in Alabama to determine the quality and extent of potential mountain lion habitat on the Plateau. We will discuss the results of this habitat suitability analysis in terms of quantity and location of suitable habitat and how these results can inform potential mountain lion reintroduction efforts or mountain lion management plans in the future.

P8 PRUE, CARIE¹, STACEY GARCIA², AND DENNIS C. HANEY¹. Furman University¹ and Ursinus College²—The effects of urbanization on fish diversity and bioindicators of fish health in the Enoree River watershed, South Carolina.

Urbanization negatively affects streams by impacting riparian zone function, reducing allochthonous food sources, and increasing runoff and erosion. We hypothesized that fish diversity and bioindicators of fish health would be lower in urban streams than rural streams. Selected stream sites near Greenville, SC were classified as rural or urban based on land cover, and fish were collected at each site using a backpack electrofisher and seine. There were no statistically significant differences in diversity or bioindicators between urban and rural sites. However, fish from rural sites exhibited an even distribution of lengths while urban fish were predominately from one intermediate size class. When comparing current data to results from 1999 (less urbanization), there was a significant decrease in overall abundance of fish. *Nocomis leptocephalus* were collected on separate trips and brought back alive to the laboratory. Gill, skin, and spleen tissue were used for antimicrobial studies. Liver and visceral masses were used to calculate liver and visceral somatic indices, respectively, and liver tissue was used to determine activity of 7-ethoxyresorufin. Results for fish from urban sites generally were not significantly different from those for rural fish. However, a number of *N. leptocephalus* studied, all from urban sites, were positive for the presence of 7-ethoxyresorufin, indicating exposure to toxins.

Although fish abundance has declined as urban land cover has expanded, urbanization does not yet appear to have significantly decreased fish diversity or health. Future studies at sites with greater urban land cover may reveal significant effects.

Animal Physiology

- P9 BARCLAY, MATT, DOUGLAS MORAN AND JONATHAN AKIN. Northwestern State University of Louisiana—Effects of atrazine on development in *Xenopus laevis*.

Atrazine is among the most commonly applied herbicides in US agriculture and may contaminate aquatic sites used by amphibians for breeding. The potential for atrazine to act as an endocrine disrupter in amphibians could affect reproductive success. We used the *Xenopus* FETAX (frog embryo teratogenesis assay) to determine whether exposure to various levels of atrazine affected development of *Xenopus laevis* tadpoles. We found that while the highest levels of atrazine exposure did produce significant deformities, including some intersex individuals, the concentration at those teratogenic levels may not be relevant to concentrations normally found in natural surface waters.

- P10 BRADY, ERIN K. AND D. JORGENSEN. Roanoke College—Ventilatory pump effect on circulatory function in the blue crab, *Callinectes sapidus*.

Blue crabs use two sets of gills for gas exchange. Each set is enclosed in the branchial chamber (BC). Each BC is ventilated by a muscle-driven pump, the scaphognathite (scaph), which generates negative hydrostatic pressure that pulls seawater through the BC. Venous systemic circulation hemolymph pools in the infrabranchial sinus (IB) located upstream from the gill circulation and collects, after passing through the gill circulation, in the pericardial space (PS) before being pumped by the ventricle into the arterial portion of the systemic circulation. We measured hydrostatic pressure in the BC concurrently with hemolymph pressure in the PS and IB (allowing for calculation of pressure drop [P_{drop}] across the gill circulation) in crabs walking on a submerged treadmill. Ventilation rate increased several-fold during exercise, driven by increased scaph activity causing a decrease in BC pressure. We hypothesized that reduced BC pressure would result in passive dilation of the hemolymph channels in the gill lamellae, resulting in decreased P_{drop} . During periods of increased ventilatory pump activity, associated with exercise, we observed a decrease in P_{drop} , 388.4Pa to 97.1Pa, across the gill circulation, supporting our hypothesis, and suggesting passive augmentation of hemolymph flow through the gill circulation during periods of increased metabolic demand.

- P11 BRYANT, MATTHEW AND DARWIN JORGENSEN. Roanoke College—Unequal hydrostatic pressure distribution in the branchial chamber of the exercising blue crab, *Callinectes sapidus*.

Gas exchange is carried out in the blue crab, *Callinectes sapidus*, using two sets of gills which extend laterally from the body surface on either side of the thoracic region of the crab. These two gill sets, each enclosed in an individual branchial chamber (BC), comprised of six individual gills. Each gill consists of a stack of plates called lamellae. In each gill, two large vessels carry hemolymph to and from a network of small hemolymph channels that transverse the lamellae. Each gill chamber has its own ventilatory pump (the scaphognathite or scaph) that generates a slight negative pressure (suction) to pull water through the BC and past the gill set. Our previous work has shown that under exercise conditions, increased ventilation is driven by increased scaph activity that generates greater suction in the BC; and we have assumed that BC pressure is homogeneous. The present study is designed to test this assumption. Catheters, connected to strain gauge transducers, were positioned to measure pressure in three different locations along the longitudinal axis of the BC in crabs that walked on a submerged treadmill. Our results indicate that during and after a period of exercise, the BC pressure, which is relatively uniform under resting conditions (mean value= -100 Pa), becomes unequally distributed

(two-fold lower in the posterior region of the BC). This may result in unequal lamellar hemolymph flow distribution across the gill set.

- P12 CHAO, MATT AND SANDRA F. LARSON. Furman University—Physiological and reproductive responses of fish to zinc contamination in a tributary of the Enoree River in Travelers Rest, SC.

Heavy metal bioaccumulation in aquatic organisms is an active area of research. Metals such as zinc are considered micronutrients and are necessary for various physiological processes including enzymatic reactions. High levels of zinc, however, are considered toxic to fish and other organisms. Several studies have already investigated lethal concentrations of zinc in various species. The present study investigated the physiological and reproductive responses of fish to zinc contamination from an accidental release of galvanizing waste from a retaining pond. Water and fish were collected from eight sites downstream from the spill site. Fish were collected using an electrofisher backpack and anode, with a range of 2-12 fish caught per site (mean of 7 fish/site). Zinc analysis of water and samples of gill, liver and gonadal tissues were performed using inductively coupled plasma – atomic emission spectroscopy (ICP-AES). Mean zinc concentrations were analyzed by GLM using SPSS software. Concentrations of zinc in the water varied from 15-0.13 ppm. Preliminary results showed that liver tissue zinc concentrations decreased as distance from the spill site increased ($p=0.022$). Zinc concentrations in gill tissue followed a similar trend ($p = 0.069$). Interestingly, gonadal zinc concentrations remained low and unchanged regardless of levels in gill or liver tissue. This suggests a possible protective measure in the preservation of gametes when fish are exposed to contaminants in the environment.

- P13 DUDLEY, BREANNA, MICHAEL GOLOUBEV, RICHARD DENISE, AND MITSUE WIGGS. Bowie State University—Concealed hypodermic syringe.

The sight of any needle not only amplifies or exasperates fears but also the perception of pain. Apprehension concerning needles has been present in the medical professionals for decades. With the advent of modern technology and biomedical engineering it is now possible to conceal needles to reduce the amount of apprehension felt by the patient. The objective of this project is to create a syringe with a hidden needle. Conceptual computer simulations have been run for a device that conceals the needle and works according to the same principle as a regular hypodermic syringe. Using CAD (computer aided design) a three dimensional model of such device has been created and analyzed. This new device can be used in any medical facility that would deal with patients that are easily scared by the needle. The cost of such syringe would not be significantly higher than conventional means; however, it would be more beneficial to the patient by relieving unnecessary stress. The design is protected by an intellectual property disclosure.

- P14 HINLICKY, ANGELA AND D. JORGENSEN. Roanoke College—Distribution of hydrostatic pressure in the branchial chamber of the American lobster, *Homarus americanus*.

The American lobster, *Homarus americanus*, is a commercially-important, migratory, decapod, crustacean arthropod. Lobsters have two sets of gills each enclosed in a branchial chamber (BC) located on either side of the thorax. Each BC contains a scaphognathite (scaph), a muscularly-driven pump, which generates a cyclic, suction pressure in the BC to move water unidirectionally past the gill set and through an exhalant opening located lateral to the mouth. It has been assumed previously that pressure resulting from scaph movement is equally distributed in the BC. We wish to determine the validity of this assumption. We measured pressure mid-laterally at different locations along the longitudinal axis of the BC using catheters attached to strain gauge pressure transducers. Our data indicate that pressure is unevenly distributed in the BC in resting lobsters, being more negative in the anterior and posterior regions of the BC compared to the mid-longitudinal region (3-4-fold lower). Previous work has shown that BC pressure decreases during exercise as a result of increased scaph activity. During steady-state walking on a submerged treadmill, we found that pressure decreased in all regions but to

a greater extent in the anterior and posterior regions. This may have implications regarding hemolymph flow through the gills.

- P15 SHANK, JILLIAN AND CHRIS NICOLAY. University of North Carolina at Asheville—Cranial morphology of vampire bats (Phyllostomidae: Desmodontinae).

As the only mammals that feed exclusively on blood, bats of subfamily Desmodontinae occupy a unique functional and ecological niche. The three species of Desmodontinae feed on different hosts. *Desmodus rotundus* feeds primarily on mammalian blood, while *Diaemus youngi* and *Diphylla ecaudata* emphasize avian blood. Principle Component (PC) Analysis was conducted to (1) examine how vampires differ from other phyllostomids with different diets, and (2) identify patterns of morphological variation within the three species of desmodontines. 13 cranial measurements were taken on 105 individuals of the three desmodontine species (*Desmodus rotundus*, *Diphylla ecaudata*, and *Diaemus youngi*) and 114 individuals from 8 other phyllostomid species. The first PC Analysis demonstrated that desmodontines are morphologically distinct from other phyllostomids. PC1 (which loaded positively with all measurements, reflecting size) and PC2 (which loaded with relative length and width of the rostrum and mandible) distinguished desmodontines from other phyllostomids as small bats with short, blunt snouts, and short, wide mandibles. A second PC analysis that examined only desmodontines showed that each species has a distinct cranial morphology. PC1 (size) separated *Diphylla ecaudata* from the two larger species. PC2 separated *Diaemus youngi* from the other vampires based on its shorter, wider skull and mandible, reduced canine length, and taller coronoid process. The distinct morphologies of the three species of desmodontines indicate that even within the unique, specialized niche of blood-feeding, species employ different strategies to meet varying feeding demands.

- P16 COWELL, MACKENZIE, WILLIAM STOUDEMIRE, STEVEN PRICE AND MICHAEL DORCAS. Davidson College—Comparative water loss and rehydration in three species of Plethodontid salamander with temperature variation.

The preferred habitats of plethodontid salamanders in the western Piedmont of North Carolina range from completely terrestrial (white-spotted slimy salamander; *Plethodon cylindraceus*), to mostly aquatic (northern dusky salamander; *Desmognathus fuscus*). The southern two-lined salamander (*Eurycea cirrigera*) is also aquatic, but ranges into terrestrial environments more commonly than *D. fuscus*. We tested the hypothesis that more terrestrial species would have lower evaporative water-loss and higher rehydration rates than more aquatic species by comparing evaporative water loss in these species at 5°C, 15°C, and 25°C. We found that *P. cylindraceus* had lower evaporative water-loss rates than the more aquatic forms. However, *D. fuscus* had slightly lower evaporative water-loss rates than *E. cirrigera* ($p < 0.0001$). At 5°C and 15°C evaporative water-loss rates were similar within species, but rates increased at 25°C. Rehydration rates (conducted at the same three temperatures as dehydration) were not significantly different between species ($p > 0.05$), although they did increase with temperature. Our results generally support our hypothesis that more aquatic species tend to lose water at higher rates and indicated all species experienced substantial water loss at 25°C (average water loss $> 25\%$ body weight). However, explanations for a higher evaporative water-loss rate in *E. cirrigera* than in *D. fuscus* remain elusive.

Aquatic Wetland and Marine Management

- P17 AMMAY, KRISTEN¹, CLARYMAR ORTIZ², DENNIS C. HANEY¹, AND JOHN WHEELER¹. Furman University¹ and Universidad Metropolitano²—Evaluating the presence of estrogen in wastewater treatment plant effluent in the Broad River watershed, South Carolina.

Synthetic and natural estrogenic compounds derived from oral contraceptives, plasticizers, pesticides and household cleaning agents are discharged into wastewater systems. Wastewater treatment plants (WWTPs) in turn discharge these compounds into

river systems. These chemicals can bind with the estrogen receptor in vertebrates and at high concentrations have been associated with reproductive failure and altered immune function in fish. The goal of this research was to design an effective procedure for detecting estrogenic activity and to quantify estrogen concentrations in the effluent of WWTPs in the Broad River watershed of South Carolina. Plants of varying sizes and levels of industrial and municipal influent were selected for study. Estrogenic compounds were first assessed by a yeast estrogen screen assay. This method measures human estrogen receptor-dependent activity by using β -galactosidase production to quantify the amount of estrogenic compounds. Results showed a weak but significant positive correlation between estrogen concentration and percent industrial influent to the WWTP, but no correlation with WWTP size. Plants with primary sedimentation and influent equalization basins contained significantly less estrogen in their effluent than plants without these features, suggesting that slower transit of wastewater through the plant reduces estrogen concentrations in the effluent. A liquid chromatograph mass spectrometry analysis was used to identify whether any of five common estrogenic compounds (estrone, estriol, 17 α -ethynylestradiol, β -estradiol, and diethylstilbestrol) were present. Low concentrations of estrone and 17 α -ethynylestradiol were detected only in a small percent of samples, suggesting that xenoestrogens may be the main source of estrogenic compounds detected in the yeast bioassay.

- P18 BABELAY, ALLISON¹, GREGORY P. LEWIS¹, C. BRANNON ANDERSEN¹, ERESHA DESILVA², EDGAR E. LOPEZ³, CARLA MEJIAS³, VALERIE NIEVES³, AND FLOYD E. STANLEY¹. Furman University¹, Texas A & M University², and Universidad Metropolitana³—Relationships between stream chemistry, suspended bacteria, and land cover in the Enoree River basin, South Carolina.

The piedmont of the southeastern United States is currently experiencing rapid urban expansion. As urban land cover expands, water quality in streams and rivers is likely to decline. For example, urban areas may have higher concentrations of stream solutes, such as nitrates, and higher abundances of coliform bacteria. Studies conducted in the Enoree River basin in South Carolina during 1999-2000 demonstrated a significant positive relationship between stream nitrate concentrations and urban land cover. To expand upon that study, we conducted a study in summer 2005 to address the following questions: (1) Have stream nitrate concentrations increased in the Enoree basin, and (2) are abundances of coliform bacteria also correlated with urban land cover? We collected water samples from 53 locations in 6 sub-watersheds in the Enoree basin. These sub-watersheds ranged from 6.5 to 80 km² in area, of which 3.7% to 64.7% was covered by urban land. As with data from 1999-2000, stream nitrate concentrations correlated positively with percent urban land cover (mean nitrate concentrations among sites ranged from 0.15 to 5.89 mg/L). For sites sampled in both 1999-2000 and 2005, there was no statistically significant difference in mean stream nitrate concentrations. Like the pattern for nitrate concentrations, there was a significant positive correlation between abundance of suspended *Escherichia coli* and percent urban land cover. However, total coliform abundance did not correlate significantly with percent urban land cover. Overall, our results suggest that urban land cover negatively affects both chemical and biological components of water quality in the southeastern piedmont.

- P19 DEES, WILLIAM H., AMY K. PHELPS, HARRY A. MEYER, CAROLINE E. CHAPMAN AND ALICE W. WARD. McNeese State University—Snail and fire ant mound abundance in natural and restored marshes in southwest Louisiana.

Efforts have been made in recent years to restore wetland areas of the Sabine National Wildlife Refuge in Cameron Parish, Louisiana. Successful restoration of a coastal salt marsh in southern Louisiana requires the success of *Spartina* populations. Ecological factors which adversely affect *Spartina* recovery may therefore affect the restoration of a salt marsh. The marsh periwinkle, *Littoraria irrorata*, which inhabits coastal wetlands from Virginia to Texas, can damage *Spartina*. This grazing can reduce marsh productivity and destroy marsh canopy. Predators of *L. irrorata* may promote salt marsh biomass productivity by preying on these snails. One such potential predator is the red imported

fire ant, *Solenopsis invicta*, which has been implicated as a predator of other snail species. In this study we assessed variation in periwinkle density among marshes differing in the degree of restoration and investigated the relationship between the densities of periwinkles and fire ant mounds. We sampled at 20m intervals along two 100m transects in each of three marsh sites - one natural and two restored. Sites were sampled in fall 2004, and winter and spring 2005. At each sampling point, the number of snails in a 2500cm² quadrat and the number of ant mounds within 4m were determined. Snail density was low throughout the marsh and showed little difference among sites. No relationship between fire ant mound and snail densities was detected. Additional planned sampling dates have been indefinitely delayed by the devastation caused to the area by Hurricane Rita.

- P20 MEJIAS, CARLA¹, VALERIE NIEVES¹, ERESHA DESILVA², ALLISON BABELAY³, GREGORY P. LEWIS³, AND C. BRANNON ANDERSEN³. Universidad Metropolitana¹, Texas A&M University², and Furman University³—Spatial variations of stream chemistry in three watersheds of varying urban land cover in northwestern South Carolina.

The piedmont of the southeastern United States is experiencing rapid urban development, which is likely to influence the biogeochemistry of streams and rivers. We examined relationships between stream chemistry and land cover in three sub-watersheds of the Enoree River in the upper piedmont of South Carolina. Percent land cover in these sub-watersheds ranged from minimal (3.7%) to moderate (50%). In two of the sub-watersheds (Beaverdam Creek and Rocky Creek), urban land cover was concentrated in the headwaters, while the third sub-watershed (Buckhorn Creek) was mostly forested with some residential areas at lower elevations. During summer 2005, we collected water samples for chemical analyses from over 40 locations in the Rocky Creek watershed, 20 locations in the Beaverdam Creek watershed and from 7 locations in the Buckhorn Creek watershed. In the Beaverdam and Rocky Creek watersheds, the highest total dissolved nitrogen, nitrate, ammonium, sulfate, and chloride concentrations occurred in the urbanized headwaters. In contrast, the Buckhorn Creek watershed had low solute concentrations in the forested headwaters and higher concentrations in downstream residential areas. Overall, nitrate concentrations were highest in the Rocky Creek watershed (up to 7.2 mg/L), lower in the Beaverdam Creek watershed (<3.2 mg/L), and lowest (<0.60 mg/L) in the Buckhorn Creek watershed. In all three watersheds, the lowest nitrate concentrations occurred downstream of artificial ponds (impoundments), and phosphate concentrations (typically <0.10 mg/L) were not significantly higher in urban than rural areas. In the future, we will examine causes of high solute concentrations in urban streams in the southeastern piedmont.

- P21 PLUTCHAK, ROCHELLE^{1,2}, C. DREW FOSTER^{1,2}, ANDREA ANTON^{1,2}, KATE SHEEHAN^{2,3}, JUST CEBRIAN^{1,2} AND KELLY MAJOR³. ¹University of South Alabama, Dept. of Marine Sciences, Mobile, AL. ²Dauphin Island Sea Lab, Dauphin Island, AL. ³University of South Alabama, Dept. of Biological Sciences, Mobile, AL—Microphytobenthic productivity associated with the placement of artificial oyster reefs in southern Alabama.

A concerted effort has been made to restore and/or rehabilitate habitats lost to the negative impacts of human activities on estuarine and coastal ecosystems. To date, the success or failure of oyster reef restoration efforts has been primarily based upon assessments of “animal” abundance (i.e., recruitment success of oysters, crabs and economically important finfish), water quality and/or productivity of surrounding grass beds. Herein, we report preliminary results from year one of a novel, interdisciplinary project designed to evaluate artificial oyster reef function. Study sites are located in six tidal creeks around Dauphin Island and Little Dauphin Island, AL; each of three experimental sites (cultch + oysters) is paired with a control site (no cultch – no oysters). Coincident with samplings for infauna, invertebrates and fish, estimates of microphytobenthic community structure, abundance and productivity are collected from the water column, sediments and in association with artificial reef structures. Together

with biological data, we are also monitoring changes in temperature, irradiance, attenuation, salinity, pH, dissolved oxygen and both inorganic and organic nutrient levels. Our first estimates indicate that the benthic community is very productive relative to that of the water column throughout much of the year, achieving net photosynthetic rates of ca. 0.50 cf. 0.15 mg O₂ L⁻¹ h⁻¹, respectively. Furthermore, the algal communities, characteristic of these tidal creeks, exhibit an impressive resilience and are able to rapidly recover (i.e., within days to weeks) from acute environmental disturbances (e.g., the major hurricane events, Ivan and Katrina).

- P22 RANNEY, STEVEN, WILLIAM ENSIGN AND JOSEPH DIRNBERGER. Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Ecoregion effects on stream fish condition factors across trophic levels.

In this study, we investigated the hypothesis that fish condition (quantified using Fulton condition factors [K]) is correlated with water conductivity. Since increased conductivity may be related to increased primary productivity, we expected to see K higher in streams that had higher conductivities. Our hypothesis was based on the ecoregion concept that suggests that areas of land with similar geologic and agricultural characteristics will have similar flora and fauna. We sampled five streams of varying conductivities (from 32 μ s – 183 μ s) in the geologically diverse Euharlee Creek watershed which flows across two ecoregions (Piedmont and Ridge and Valley) in west central Georgia. Our three target species (*Campostoma oligolepis*, *Notropis chrosomus*, and *Lepomis macrochirus*) represent three trophic levels, herbivore, insectivore and piscivore/insectivore, respectively. Therefore we would expect the effect of increased primary productivity to be most noticeable in *C. oligolepis* and least noticeable in *L. macrochirus*. Samples were obtained from June through early September. Fish were collected with a backpack electroshocker, identified to species and measured for length and weight. Contrary to our expectations, K declined as conductivity increased for all three species. This unexpected trend was attributed to a new year class of fish recruited to our samples later in the sampling season. Since condition typically increases with increasing fish size, this effectively lowered the condition factor for both *C. oligolepis* and *N. chrosomus* averaged across all age classes.

- P23 RASMUSSEN, JESSICA AND CHARLES L PEDERSON. Eastern Illinois University—Classification of Illinois lakes and reservoirs and evaluation of the potential use of phytoplankton as biocriteria.

Under the Ambient Lakes Monitoring Program (ALMP), the Illinois Environmental Protection Agency Bureau of Water (IEPA-BOW) has accumulated physical, chemical and biological data on more than 100 water bodies for over 20 years. Given the wealth of data that already exists, additional monitoring is not necessary to successfully address lake and reservoir assessment. While these data are utilized directly to evaluate attainment of water quality standards, we are developing a classification system for lakes and reservoirs in Illinois based on physical and chemical characteristics. We also seek to determine whether a water quality derived classification reflects *a priori* classes based on ecoregion or relevant geomorphological features associated with a water body. Additionally, availability of data on phytoplankton assemblages which parallels those collected on physical and chemical characteristics offers potential for development and testing of a multimetric lake and reservoir phytoplankton index of biotic integrity (LRP-IBI). Overall, this project addresses the specific IEPA-BOW initiative for refinement of lake quality indicators. Yet, the underlying motivation is to evaluate applicability of the lake/reservoir classification system and the LRP-IBI to a broader geographic region (e.g., midwestern or southeastern United States). Results will be useful for lake and reservoir management in Illinois and nationally, since this will be among the first with major focus on reservoirs.

- P24 SMITH, JOSH, WILLIAM ENSIGN AND JOSPEH DIRNBERGER. Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Ecoregion effects on physical habitat and fish community structure.

The objective of this study was to quantify differences in stream physical habitat and fish communities across an ecoregion boundary in the Euharlee Creek watershed in west central Georgia. We sampled five streams with varying degrees of influence from Piedmont and Ridge and Valley ecoregions. Physical parameters measured at each site include water conductivity, depth, velocity, substrate, discharge, local stream slope and reach slope. We sampled fish with a backpack electroshocker and all fish collected were identified, measured, weighed and released. Although water conductivity was strongly correlated with the proportion of watershed area contained in the Ridge and Valley ecoregion, there were no significant trends in the physical parameters of the sites as a function of water conductivity. There were also no significant trends in fish community structure associated with changes in conductivity. Inferences related to fish community structure are tentative due to seasonal differences in collection times among sites. Qualitative observations of differences in land use and quantitative assessment of the percentage of fine particles in the stream channel suggest that human disturbance may be a more important factor influencing both physical characteristics and fish community structure than ecoregion.

P25 SQUIRES, ERIN, JOSPEH DIRNBERGER AND WILLIAM ENSIGN. Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Ecoregion effects on stream aquatic invertebrate scraper communities.

Ecoregions are delineated based largely on terrestrial characteristics. It is unclear as to the effects of these characteristics on aquatic systems from one ecoregion to the next. To examine how aquatic invertebrate communities might respond to characteristics used to delineate ecoregions, six streams straddling the Piedmont ecoregion and the Ridge and Valley ecoregion were examined. Conductivity among 6 streams varied from 32 μs to 184 μs as a result of underlying geology (hardness of rock between these two ecoregions differs substantially). Because conductivity has been shown to influence primary productivity of periphyton it was predicted that the functional feeding group of invertebrate scrapers will increase in streams with higher conductivity. The data failed to support this prediction. Invertebrate scrapers were negatively related to conductivity and with periphyton standing crop, providing no evidence of bottom-up control of the scraper assemblage from geological effects on the periphyton community. A negative relationship between scrapers and periphyton standing crop and a positive relationship between carnivorous fish and periphyton standing crop could support a top-down hypothesis (although the grazing fish, *Campostoma oligolepis*, was positively correlated with periphyton standing crop). Conductivity changes as a result of ecoregion differences do not seem to directly affect the assemblages of invertebrate scrapers; this could be due to the close proximity of the stream sample sites in this study.

P26 STONER, RYAN, JOSEPH DIRNBERGER AND WILLIAM ENSIGN. Department of Biological and Physical Sciences, Kennesaw State University, Kennesaw, GA—Ecoregion effects on periphyton standing crops.

This study examined whether differences in underlying geology among two distinctly different ecoregions (Piedmont and Ridge & Valley) affect periphyton standing crop in 5 streams straddling the ecoregion boundary to various degrees. Conductivity was used as a measure of the influence of underlying geology on each stream because the hardness of rock among these two ecoregions differ substantially (conductivity varied from 32 μs to 184 μs over the 5 streams studied). Standing crop (biomass) of periphyton was estimated by determining the amount of chlorophyll in periphyton growing on glass slides incubated in streams for 5-14 days. Two separate studies were performed. In the first study, periphyton standing crop was not correlated with conductivity but rather most closely with overstory density. In the second study, sites were chosen with similar overstory densities. Chlorophyll concentrations increased with conductivity over 4 sites. The fifth site had high chlorophyll relative to conductivity, possibly due to anthropogenic nutrient input as suggested by the presence of large filamentous algae on slides at this site. The ratio of chlorophyll c to chlorophyll a showed a strong positive correlation with conductivity over 5 sites indicating a shift in the proportion of diatoms within these communities. The results

suggest that geology can influence periphyton standing crop and community makeup over relatively short distances.

- P27 ZOELLNER, DANIELLE C. Coastal Carolina University—Relating Plant Species Composition, Diversity and Richness to Allogenic Disturbance: Testing the Role of Fire and Clearing in Two Distinct Carolina Bay Wetland Communities.

Carolina Bays are distinctive elliptical wetland depressions occurring only on the Atlantic Coastal Plain concentrated primarily in North and South Carolina. Because of their global rarity, local abundance and unique floristic elements Carolina Bays provide an excellent opportunity to investigate rarity at multiple spatial levels. It is commonly reported that the vegetation of these diverse wetlands was historically maintained by frequent, low intensity natural fires due to their landscape position within a matrix previously dominated by the longleaf pine ecosystem. It is thought that suppression of this fire regime has detrimentally impacted floristic diversity inside Carolina Bay wetlands. In light of their “isolated” jurisdictional status and proximity to exploding human development Carolina Bays have been cited as a wetland type that is “at-risk” of significant loss and degradation. The proposed research uses an experimental approach to discern the role of fire and clearing on Carolina Bay plant community composition and diversity. By including both a “pristine” site and a wetland that has performed the function of tertiary sewage effluent treatment for the last seventeen years I address potential interactions among “natural” and human mediated disturbances. This research will be the first truly replicated study investigating the role of disturbance, both natural and human mediated, on Carolina Bay vegetation. Similarly, the proposed comparison of treatments (i.e. clearing versus fire) will offer immediate and long lasting guidance to land managers, conservationists and citizens. While applied to one particular wetland type the proposed experimental design is widely applicable to disturbance driven ecological systems.

- P28 COOKSON, NICHOLAS AND MARK S. SCHORR. Dept. of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN 37403—Landscape influences on fish assemblages in a Ridge and Valley stream in Tennessee.

We examined environmental conditions and fish assemblages at seven sites in the Mountain Creek system (Tennessee River drainage), a suburban stream in the Chattanooga area, Tennessee, May-June 2005. All study sites – second- and third-order reaches with drainage areas <17 km² – were located in the Ridge and Valley ecoregion. Watershed urban land use (mostly residential) ranged from 1.6 % to 19.0 %. Electrofishing surveys yielded a total of 21 species and 3,688 fish. Index of biotic integrity (IBI) ratings ranged from poor to fair/good at the individual sites. Study reaches characterized by increased water temperatures and sediment depths exhibited lower IBI scores ($P < 0.10$). Watershed urban land use was negatively correlated with species richness and diversity ($P < 0.05$). Forest cover in the watershed was positively correlated with species richness and diversity ($P < 0.10$). Local riparian plant/wetland cover was not significantly correlated with stream conditions ($P > 0.10$). Findings from this study underscore the negative impact of suburban development on fish species diversity in a small southeastern stream.

- P29 DYER, SUSAN A.¹, MICHAEL H. PALLER², MARCEL J. M. REICHERT³, AND FRANK C. HELIES⁴. ¹Westinghouse Savannah River Company, ²Savannah River National Laboratory, ³South Carolina Department of Natural Resources, Belle W. Baruch Institute for Marine Biology and Coastal Research—Utilization of disturbed and undisturbed bottomland floodplains by larval and juvenile fish.

Larval and juvenile fishes have distinctly different patterns of habitat use than adults, and an understanding of the habitats utilized by early life history stage fishes is an important consideration in impact assessment. Sampling was conducted on two undisturbed and two disturbed stream systems at the Savannah River Site. The disturbance consisted primarily of low level radionuclide contamination and physical habitat alterations resulting from past nuclear reactor operations. Light traps were used to collect juvenile/larval fish, and abiotic data was collected to identify patterns among habitats, among years, and

between disturbed and undisturbed streams to determine patterns responsible for larval fish distribution and abundance. The results show there is segregation of fish species among different habitats based on different floodplain zones (main channel, side channel, and backwater) and disturbance, with habitat related differences being greater than disturbance related differences. Similarly, most abiotic variables differed strongly among main channel, side channel, and backwater habitats. Despite having the highest level of contamination, Fourmile Branch supported substantially higher numbers of larvae and taxa than the undisturbed streams indicating that low level radionuclide contamination did not reduce fish reproductive success. A comparison of the reproductive chronology of tessellated darters and dusky shiners in Fourmile Branch and Upper Three Runs did not show an observable difference between the two systems. Larval abundance was relatively low in Steel Creek, the other disturbed stream, because of cold hypolimnetic discharge from an upstream reservoir.

Developmental Biology

- P30 EAKINS, GREGORY, BIANCA JEFFERSON, WILLIE JOHNSON AND GISELLE THIBAUDEAU. Mississippi State University—Novel approaches to analyze pigment-cell interactions.

Neural crest cells are multipotential stem cells that contribute extensively to vertebrate development as they give rise to various cell types, including all pigment cells of the body. As in other amphibians, the axolotl neural crest gives rise to three pigment-cell types; melanophores, xanthophores, and iridophores. A common feature of many salamander pigment patterns is a series of alternating light and dark regions, arranged to form either horizontal stripes or vertical bars. Light stripes or bars include xanthophores and dark stripes or bars include melanophores and may or may not include xanthophores. Earlier work suggests that bars and stripes of salamander pigment patterns are likely to depend on xanthophore-melanophore interactions. Ultimately, we would like to know whether these interactions occur, which genes are required for xanthophore development, and what influence these genes have on xanthophore-melanophore interactions. By manipulating and culturing the embryonic neural crest of the axolotl, we are able to observe behaviors of individual cells *in vitro* and/or *in vivo* in time-lapse, while the pigment pattern is developing. Geospatial imaging and analysis software was used to identify consistencies and differences in melanophore vs. xanthophore migration and distribution. ImagePro Plus imaging software was used to acquire Z-series stacked images of hatching stage embryos during establishment of pigment pattern (every 0.5 hr for 128 hr or until pattern was established). Collaborators of the Engineering Research Center converted 2D images into a 3D volume (Amira Software). Image segmentation algorithms have been applied and Cave Automatic Virtual Environment applications are being developed.

- P31 JEFFERSON, BIANCA, DONG-JUN LEE AND GISELLE THIBAUDEAU. Mississippi State University—Developmental expression of TRP-1 in the Axolotl.

In the mammalian pigmentary system, the enzymatic production of melanin from tyrosine involves the action of tyrosinase, tyrosinase-related protein-1 (TRP-1) and TRP-2. TRP-1 has DHICA-oxidase activity and is important in stabilizing melanosomal enzyme activity. Amphibians have three classes of neural crest-derived pigment cells, melanophores, xanthophores, and iridophores. Proteins of the tyrosinase family play important roles in regulating the quantity and quality of melanin produced within the melanophore. Expression of TRP-1 is regulated in a pigment cell-specific manner during development. Although pigment cells are useful to studies of development, relatively little is known about pigment-cell specific gene expression patterns during the development of pigment pattern. Semi-quantitative and real-time RT-PCR of wild-type and pigment-mutant axolotl embryos were used to elucidate the expression pattern of TRP-1. Expression of TRP-1 increases during early stages of development and culminates at hatching in the wild type and all pigment mutants. TRP-1 is then down regulated in the wild type and the white mutant, but up regulated in albino and melanoid mutants. Expression of TRP-1 correlates well with overt melanophore differentiation in the wild type and white mutant animals and gives

some interesting insights into the albino- and melanoid-mutant phenotypes. We suggest that TRP-1 is stimulated by a feedback mechanism in albino embryos, whereby the system attempts to synthesize melanin in amelanotic melanophores and/or existing xanthophores and that the melanoid mutation is due to an interruption in the feedback mechanism involved in TRP-1 inhibition. The importance of TRP-1 in the development of pigment phenotypes is discussed.

- P32 JEFFERSON, LARHONDA AND GISELLE THIBAUDEAU. Mississippi State University—Fms, a xanthophore-specific gene in *Ambystoma mexicanum*.

The neural crest, a pluripotent population of migratory embryonic cells, gives rise to a variety of cell types, including pigment cells of the body. Pigment patterns are one of the most prominent features of many organisms and serve many functions, including camouflage, predator avoidance, and species recognition. Pigment patterns are of interest to developmental and cell biologists; accessibility to observation and manipulation has made them an enduring system for identifying cellular and genetic mechanisms of development and evolution. The study of pigment cells provides insight into the importance of cell migration, pigment-cell differentiation, pigment-cell interactions, and evolutionary significance of pigment pattern development in animals. *Ambystoma mexicanum* (the axolotl), displays a mottled olive green/black pigment pattern, resulting from differentiation of, abundance of, spatial arrangement, and interaction between three pigment cell types; black melanophores, yellow xanthophores, and reflective iridophores. Many mechanisms of melanophore development have been elucidated, but relatively little is known about mechanisms involved in xanthophore development. Recently, *fms*, a type-III tyrosine-kinase receptor, has been identified in the zebrafish and is expressed in xanthophores and xanthophore precursors. *Fms* is vital for xanthophore differentiation, stripe development, melanophore-xanthophore interactions, and pigment-pattern formation. Here, we use RT-PCR to identify, *fms*, a xanthophore-specific gene, in the axolotl. Identification of *fms* will facilitate future studies, designed to elucidate mechanisms of xanthophore differentiation, melanophore/xanthophore interactions, and pigment pattern formation.

- P33 NIEDZIELA, LINDA, NICOLE MILLER AND ASHLEY JOHNSON. Elon University—Toxicity assessment of Dispersit SPC-100™ oil dispersant in brine shrimp *Artemia salina*.

Oil dispersants aid in oil spill abatement in marine environments. Their dominant components are surfactants which can disturb vital functions in aquatic organisms, including juvenile development and cell membrane integrity. Brine shrimp, aquatic crustaceans, are utilized as a model for the evaluation of environmental toxicology. This study assessed the toxicity of Dispersit SPC-100™ on brine shrimp using standard mortality assays, developmental evaluations and measurement of membrane ATPase enzyme activity. Mortality studies were performed on pooled samples of brine shrimp treated with a concentration range from 100 ppb to 10,000 ppm. The results of these studies allowed a sub-lethal treatment range of 100 ppb to 1 ppm to be determined for the developmental and ATPase assays. Body length is directly related to stages of juvenile development. Using a micrometer, 25 randomly-chosen shrimp were measured at 100X magnification after 48 exposures. Toxicity results were based on two replicates of three pooled samples per treatment. Data supports an increasing incidence of developmental arrest in brine shrimp exposed to Dispersit SPC-100™. A variety of contaminants alter ATPase activity. Membrane enzymes, such as ATPase, are involved in the transport of electrolytes across the membranes of aquatic organisms. Surfactants have the potential to interfere with the ATPase function. Total protein concentration was determined by Bradford assays before ATPase activity was analyzed using EnzChek® Phosphate Assay. While oil dispersants are crucial to limit the detrimental environmental impact of oil spills, this study considers the possibility that the dispersants may also have a negative effect on the environment.

Genetics, Cellular and Molecular Biology

- P34 ARCHIE, ALICIA AND SANDRA F. LARSON. Furman University—Detecting transcripts of bovine epidermal growth factor receptor.

The epidermal growth factor receptor (EGFR), located on the epithelial cell layer of the bovine ovary, is normally involved in proper follicle growth. Over expression of EGF and its receptor may also contribute to ovarian cancer. Different forms of the EGFR have been sequenced in humans and mice, and expression levels of some of the EGFR forms can be used in developing a prognosis for patients with ovarian cancer. The objective of this experiment was to determine whether multiple forms of bovine EGFR are expressed. Total cellular RNA was isolated from bovine ovarian tissue using the Invitrogen RNA purification kit. Reverse transcriptase polymerase chain reaction (RT-PCR) was performed on the bovine RNA, using 22 sets of primers based on the porcine EGFR sequence. After each reaction, the products were separated via agarose gel electrophoresis to determine product sizes. The products were then sequenced and compared to the known porcine EGFR sequence to verify the bovine EGFR sequence. Afterwards, 3' random amplification of cDNA ends (RACE) was performed using 5' primer from RT-PCR and a poly T primer. This resulted in 3-4 different bands on the agarose gel, indicating a likelihood that transcripts of varying lengths were present. We are currently cloning and sequencing these transcripts. Once proper sequences are determined, differences in gene expression patterns of EGFR between normal and cancerous ovarian cells will be determined. This could lead to a better understanding of EGF and EGFR in normal ovarian physiology and in ovarian cancer development and progression.

- P35 BRYANT, DESIREE, AND DR. DEBORAH RAYFIELD. Bowie State University, 14000 Jericho Park Road, Bowie, MD—The effect of Estrogen, Daidzen, and Genistein on PC-12 cell viability following hypoxic/ischemic exposure.

The Women's Health Initiative spearheaded a large randomized study to look at primary prevention of cardiovascular disease in menopausal women. The study was prematurely ended when interim analysis demonstrated an unacceptable risk profile related to an increase in the incidence of breast cancer, with no cardiovascular protection. Data from this study suggests an increase in blood clots, strokes, and coronary disease. A common denominator among these disorders is hypoxia. The intent of the study is to measure the effect of genistein, 17-beta estradiol, and daidzen on changes in PC-12 cell viability following exposure to hypoxia and ischemia. PC-12 cells were chosen due to their enhanced oxygen sensing capabilities. The specific aims of this study are to (1) measure the effect of genistein, 17-beta estradiol, and daidzen on PC-12 cells exposed to time intervals of hypoxic and ischemic exposures (2) determine the role of tyrosine inhibition on observed responses, and to (3) measure the ability of genistein, daidzen, and 17-beta estradiol to prevent thapsigargin induced apoptosis in PC-12 cells. Cell death will be monitored by measuring the release of lactate dehydrogenase enzymatic activity into the culture supernatant. Differentiated and undifferentiated PC-12 cells will be maintained in a suspension culture until used for assay. Ischemic conditions will be simulated by exposing cells to an aglycemic and hypoxic conditions. Data will be analyzed using a one way analysis of variance with Bonferroni corrections for multiple comparisons or by using the Student's test P values < 0.05 will be considered statistically significant.

- P36 CHANDLER, EMMANUEL L AND SANDRA F. LARSON. Furman University—Effects of epidermal growth factor and follicle stimulating hormone on epidermal growth factor receptor expression in ovarian cancer cells.

Epidermal growth factor receptor (EGFR) acts as a prognostic indicator for ovarian epithelial tumors and its expression is upregulated by several types of hormones. This study tests whether expression of EGFR is stimulated by follicle stimulating hormone (FSH), and whether EGF and FSH stimulate cell proliferation in an ovarian cancer cell line. Ovarian cancer cells, cell line SK-OV3, were cultured for 48h in each of the following treatments: epidermal growth factor (EGF) (40 ng/ml), FSH (200 ng/ml), EGF + FSH (40

ng/ml + 200 ng/ml), and no hormone. Cell proliferation was evaluated by determination of the number of cells/mm² on the slide after the culture period. Expression of EGFR was detected via immunocytochemistry. Cell count and expression levels of EGFR were analyzed by ANOVA, and differences between treatments tested using Tukey's HSD. Based on the cell counts, FSH had a tendency to increase cell number compared to the control ($p=0.102$). EGF alone or in combination with FSH increased cell number ($p=0.014$), but with no additive effects when both compounds were present. EGFR expression was found not to be affected by FSH ($p=0.718$), but EGF and EGF + FSH significantly reduced EGFR expression ($p<0.0001$) in the SK-OV3 cells. In conclusion, while FSH tended to increase cell proliferation, there was no effect of FSH on EGFR expression. In contrast, exposure of SK-OV3 cells to EGF alone or in combination with FSH significantly enhanced cell proliferation, and resulted in down-regulation of expression of EGFR.

P37 COBB, CRYSTAL¹, DIANA ACKAH¹, CAROLYN HOPPE M.D.², JAMES G. TAYLOR VI M.D.¹Vascular Medicine Branch, NHLBI, National Institutes of Health, Bethesda, MD 20892² Department of Pediatric Hematology/Oncology, Children's Hospital, Oakland, CA 94609—Establishing the incidence of putative genetic modifiers in DNA samples of newborns with Sickle Cell Disease from a state newborn screening program.

Sickle cell disease (SCD) is characterized by a wide phenotypic spectrum of complications that are hypothesized to be partly attributable to inter-individual variation in modifier genes outside the mutated *HBB* locus. The long term objective of our lab is to identify and characterize genetic modifiers that predict early mortality or prolonged survival in SCD. Recently, we identified a variant in the Vascular Cell Adhesion Molecule 1 promoter on chromosome 1 which is present in 3.7% of adult SCD patients ($n=81$; mean age 37 years), while its prevalence in 1286 healthy individuals from global populations is nearly 0.2% ($P<0.001$). We hypothesize that this increased prevalence in the adults with SCD may be due to a selective advantage for carriers of this variant. To test this hypothesis, we collected 117 anonymous blood samples from a state Newborn Screening program identified as individuals with a diagnosis of SCD. Overall, there are 78 samples with homozygous SCD (SS; 67%), 12 with sickle beta-thalassemia (S β thal; 18%) and 18 with hemoglobin SC disease (SC; 15%). Recovery of genomic DNA from very small amounts of blood ranged from 0.7 to 44.1 micrograms (mean 12.2 micrograms). We are presently confirming the reported SCD diagnoses and the incidence of the *VCAM1* promoter variant by DNA sequencing. Finally, we will be “fingerprinting” these samples with 16 additional DNA markers to further determine overall sample quality and yield. Overall, this population represents an important resource for examining the effects of genetic modifiers in newborns and adults with SCD.

P38 COLE, BYRON, SUROBHI LAHIRI, LAKSHMIDEVI PULAKAT AND NARASAIAH GAVINI. Mississippi State University—Role of NifX in FeMo-cofactor synthesis and transport.

The nitrogenase enzyme catalyzes the reduction of dinitrogen to ammonia and is composed of the Fe and MoFe proteins. The iron molybdenum cofactor (FeMo-co) of the MoFe protein is the site of active substrate reduction. It has been proposed that FeMoco biosynthesis starts with the mobilization of iron and sulfur; the Fe-S fragments are subsequently transferred to NifB and the resultant NifB-co is then transferred to NifEN, where it is probably rearranged by the Fe protein (NifH). The NifX protein has also been suggested to have a role in the FeMo-co synthesis, although its exact role is still open to investigation. We attempted to understand the role of NifX by determining the specific interactions it may have with other Nif proteins involved in FeMo-co synthesis, such as NifD, NifK, NifE, NifN, NifB and NifH. Using the BacterioMatch Two-Hybrid System, a translationally fused construct of NifX with the N-terminal α -RNAP of the pTRG target vector was made and its interaction was tested with the NifDK fusion protein, translationally fused to the λ CI of the pBT vector. The strength of the interaction, as determined by measuring the β -galactosidase activity, demonstrated that direct protein-

protein interaction exists between NifDK and NifX proteins; the extent of interaction between NifK and NifX proteins was much higher than between NifD and NifX, when individually tested; also, reduced interaction was found between NifH and NifX. Our studies involving the interaction of NifX with NifB, NifE and NifN will finally help in revealing the series of steps involved in the FeMo-co synthesis.

- P39 DONG, HANQING, PREETI PATIL, LAKSHMI PULAKAT AND NARA GAVINI. Mississippi State University—The role of nif-specific Orf9 in Azotobacter vinelandii.

Nitrogenase, which catalyzes the biological reduction of atmospheric nitrogen, consists of the Fe and the MoFe protein encoded by *nifH* and *nifDK* genes respectively. The Orf9 of *Azotobacter vinelandii* exhibits about 53% identity and 75% similarity with ClpX. ClpX is an ATPase involved in substrate recognition. It interacts with ClpP to form ClpXP, which is an ATP dependent protease complex found in many prokaryotes and eukaryotes. In order to decipher the functional role of Orf9 in the biogenesis of nitrogenase, we have investigated its interaction with proteins encoded by *nif*-structural genes, the *nifHDK*, by utilizing BacterioMatch™ Two Hybrid system. The DNA corresponding to *orf9* was PCR amplified and cloned in pBT and *nifH*, *nifD*, and *nifK* were cloned in pTRG. The interactions of Orf9 with Nif proteins were detected by analyzing the expression of the reporter genes, the *lacZ* and *bla*. The Orf9 showed positive interaction with NifK, whereas no detectable interaction was observed between NifD and NifH. Amino acid sequence comparisons revealed that carboxyl terminus domain of NifK shares about 36% homology with the SsrA tag, the ClpX recognition sequence. A deletion in carboxyl terminus domain of NifK abolished its interaction with Orf9. Furthermore, based on an analysis of interactions of ClpX with the three Nif proteins, we proposed that the Orf9 is a *nif* specific ClpX and its putative functions include a role in MoFe-protein assembly. The growth analysis also indicated that Orf9 plays an important role in nitrogenase activity during pH stress conditions.

- P40 DOZIER, MONICA, GEORGE UDE, PH.D. AND DENNIS SCOTT. National Center for Food Protection and Defense, University of Minnesota, Minneapolis, MN 55455—Detection and diagnostics: techniques and applications for food protection and defense.

In the summer of 2005, the Department of Homeland Security (DHS) permitted faculty/student teams from minority institutions an opportunity to engage in research at participating DHS affiliated venues. The mission of this DHS Center of Excellence is to protect the safety of the Nation's food systems the education and research. At the Detection and Diagnostic Unit of NCFPD in the Institute of Plant and Microbial Genomics, students were able to research the latest molecular biology techniques used in the detection and diagnostic of microbes. These techniques include Real Time Polymerase Chain Reaction (RT-PCR), which detects RNA and DNA amplification in real time, using fluorescence emission; microarray technology, which is useful for comparative genome analysis, and Bioinformatics. RT-PCR was used to amplify a 10x serial dilution of DNA from *bacillus anthracis* (anthrax). A standard curve was generated with anthrax cells of known concentration, which allow the detection of anthrax contamination in unknown samples. Microarray technology was used to check genetic conservation among the genomes of two isolates of *staphylococcus aureus*: PSA 72 from Pennsylvania, and RF 122 from Ireland. Through bioinformatics, the results indicated that both isolates have 3071 genes in common and 65 genes were unique to RF 122. Although the two samples are isolates of the species, they differed in their genetic constitution. The small differences may be responsible for the adaptive advantages that the isolates have over each other. Nevertheless, further research is necessary to confirm that the 65 genes identified are certainly absent in PSA 72.

- P41 HARRIS, JR., KELVIN; Nara Gavini and Lakshmi Pulakat. Mississippi State University—Understanding the NifM dependence of NifH in Azotobacter vinelandii: Functional substitution of nifH by a chimeric nifH-chlL construct in a nifM- strain.

The enzyme nitrogenase catalyzes the energy-dependent reduction of dinitrogen to ammonia via biological nitrogen fixation. Nitrogenase is composed of two metalloproteins known as the molybdenum-iron (MoFe) protein and the iron (Fe) protein. The Fe protein, a 60-kDa dimer of the product of the *nifH* gene, contains a single 4Fe-4S cluster and two Mg-ATP-binding sites, one at each subunit. The Fe protein is the obligate electron donor to the MoFe protein. To date, no other mutual protein has shown to substitute Fe protein in biological fixation, and the NifH is functional only in the presence of the *nif*-accessory protein NifM. Interestingly, the protochlorophyllide reductase (ChlL) encoded by the *chlL* gene of *Chlamydomonas reinhardtii* shows significant homology and structural similarity with NifH. Previously, our laboratory has shown that the ChlL can substitute the Fe protein in the functioning nitrogenase only in the absence of NifM. We have also shown that the NifM is a PPIase and the Pro-258 located in the C-terminus of NifH is one of the substrates for NifM. Since the least structural homology exists between NifH and ChlL at the C-terminal region, we hypothesized that we can generate a NifM-independent NifH-ChlL chimeric protein by replacing the C-terminus of NifH (that spans the substrate of PPIase) with that of ChlL. To test this idea we created a chimeric construct by replacing the NifH C-terminal region (residues 248-291) with the ChlL C-terminal region (residues 240-294). The chimeric gene was then transformed into the *nifM*- *Azotobacter vinelandii* strain AV98. While the wild type *nifH* could not render a Nif+ phenotype to the *nifM*- AV98, the chimera could impart Nif+ phenotype to this *nifM*- strain. This result demonstrated that the NifH-ChlL chimeric protein is NifM-independent.

P42 JAMNEKAR GIRISH V, Lakshmi Pulakat and Nara Gavini. Mississippi State University—NifM independent Fe-protein: Regions of Fe-protein involved in post-nifM mediated conformation of Fe-protein.

Nitrogenase is composed of two separately purified components, the Fe-protein and the MoFe-protein. The Fe-protein, encoded by the *nifH* is a dimer with each subunit wrapped around the other. The *nifM* is an accessory gene of nif-gene cluster required for accumulation of active Fe-protein. Previous results suggested that the *nifM* gene product plays an important role in conferring activity and some stability to the Fe-protein. It is also suggested, that it has PPIase domain. Hence, it may be involved in conformation change of Fe-protein. Based on this reasoning, we isolated a mutant (pBG1161) *Azotobacter vinelandii* strain in which the NifM-protein is no longer required for nitrogenase activity by screening in *nifM* deleted *A. vinelandii* (Av98). Growth curve analysis showed that the pBG1161 was able to support growth in Av98. Further analysis showed that the *nifH* gene from this mutant strain contained multiple mutations spanning three easily recognizable regions in the Fe-protein. Translational fusion of RNA polymerase α-subunit and bacteriophage λ cl repressor protein, of regions amino acids 30-73 (F1), 205-240 (F2), 240-289 (F3) and F2 region from pBG1161 (MF2) were constructed and co-transformed in reporter strain of Bacteriomatch II hybrid system. MF2 show increased interaction as compared to wild type F2 with F3 region of *nifH*. This suggests increase of inter-subunit interaction as F3 of one subunit envelops around F2 of other subunit of Fe-protein. These analyses, combined with molecular modeling analysis showed that the region spanning amino acids 220 to 240 may be involved in the post NifM-mediated conformation of the Fe-protein of nitrogenase.

P43 LAHIRI, SUROBHI, RITESH TANDON, LAKSHMIDEVI PULAKAT AND NARASIAH GAVINI. Mississippi State University—Identification of a second site compensatory mutation for Azotobacter vinelandii UW97 in the beta subunit of the MoFe-protein.

Azotobacter vinelandii UW97 is not capable of diazotrophic growth due to a specific mutation in the *nifH*. This mutation replaces serine by phenylalanine at position 44 rendering the NifH protein incapable of its functions. The loss of function of the Fe-protein due to this mutation was modeled to be a conformational disruption of the second conserved domain on the Fe-protein. This disruption impairs the protein in attaining the proper conformation to interact with the MoFe protein and other accessory proteins. We have isolated second site genetic mutants of *A. vinelandii* UW97, specifically in the beta

subunit of the MoFe-protein by using *nifK* subjected to spontaneous mutagenesis in DNA repair compromised *E. coli* XL1-RED cells. Further analyses by nucleotide sequencing and genetic complementation showed that the *A. vinelandii* strain UW97 retained the original mutation at Ser44Phe while acquiring Tyr98Cys and Ala122Glu suppressor mutations in the beta subunit of the MoFe-protein. In order to determine whether both mutations in the altered NifK were responsible for the suppression of the Ser44Phe mutation in NifH or either of Tyr98Cys or Ala122Glu mutations could be singly sufficient, we investigated the effect of the single mutations in a newly constructed UW97-*nifK*-Kan strain. Our initial experiments indicate that the Ala122Glu mutation could singly suppress the Ser44Phe mutation of NifH in UW97. Protein structural modeling studies show that residue 122 of NifK is positioned more closely to Ser44Phe of NifH than Tyr98, thus being a possible factor in the suppression of the Nif- phenotype of UW97.

- P44 LU, LI; DAVID A. FRANCKO; AND KENNETH G. WILSON. Miami University, Oxford, OH—The identification of CBF/DREB homologs in cold-hardy and cold-sensitive palms.

Cold is a major environmental limitation to the distribution and productivity of plants. In plants, the *CBF* genes play an important role in cold acclimation. They have been identified in many plant species, including *Arabidopsis*, *Brassica napus*, rye, wheat, rice, tomato, and etc. We report the identification of possible *CBF* homologs in a variety of palm genera (*Rapidophyllum*, *Sabal*, *Elaeis*, *Trachycarpus*, *Chrysalidocarpus*, *Ravenea*, *Attalea* and *Cocos*). Although palms are predominantly tropical to subtropical plants, some of them show strong cold resistance. In field studies, *Rapidophyllum hystrix* and *Sabal palmetto* can survive temperatures approaching -18°C with little or no foliar damage. To investigate the mechanism of this cold resistance, we cloned and sequenced *CBF*-like genes from both cold-hardy and cold-sensitive palms. The expression patterns and functions of these palm genes have been analyzed and compared with *Arabidopsis-CBFs*. Two *CBF*-like genes isolated from *R. hystrix*, one of the most cold-hardy palms in our record, have been transformed into *Arabidopsis*. The transformants show significant increase in cold tolerance. The possibility of applying our research to commercial palm and other tropical plants production will be discussed.

- P45 MAYNE, IAN P. AND MARGARET KOVACH. University of Tennessee at Chattanooga—Examination of the ACE and ACTN3 genes in UTC varsity athletes and sedentary students.

Growing evidence suggests that genetic variants of certain genes are linked to athletic performance. This study presents a comparative analysis of genetic variation of the *ACE* gene and *ACTN3* genes in varsity athletes and sedentary students at the University of Tennessee at Chattanooga. The *ACE* gene codes for the Angiotensin Converting Enzyme and indirectly regulates blood pressure and electrolyte balance. Polymorphisms of the gene effect serum and tissue levels of the enzyme, and are genetically distinguished by either an insertion (I-allele) or deletion (D-allele). The Insertion allele is thought to be beneficial to endurance athletes. On the other hand, the *ACTN3* gene, which encodes an actin binding protein, is thought to be advantageous to events that require short bursts of force such as sprinting. The polymorphisms identified in exons 15 and 16 are of importance to the *ACTN3* gene function. A point mutation in exon 15 introduces an R→Q substitution at residue 523 of this protein. Similarly the polymorphism in exon 16 manifests as a premature stop codon at position 577. Polymorphisms of the *ACE* and *ACTN3* genes were evaluated by PCR and RFLP analysis. In the athlete's 23.6% had the I allele and 76.4% had the D allele. In the control subjects, 8.3% had the I allele and 91.7% had the D allele. Further examination of the *ACTN3* gene between both groups will ascertain if there are any antagonistic relationships between these genes.

- P46 MITCHUM, KATHERINE A., KHYATI H. BAXI, N. MOSES LEE, AND ELIV. HESTERMANN. Furman University—Antagonism of the aryl hydrocarbon receptor by 3'-methoxy-4'-nitroflavone.

Aryl hydrocarbon receptor (AHR) agonists include potent teratogens, immunotoxicants, and carcinogens, and AHR antagonists have been proposed as a method to treat or prevent this toxicity. We synthesized the AHR ligand 3'-methoxy-4'-nitroflavone (MNF) and tested its antagonistic properties in H1G1.1 mouse cells transfected with a green fluorescent protein reporter gene preceded by an AHR-responsive promoter. These cells were treated with increasing concentrations of the AHR agonist 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) at several concentrations of MNF. The TCDD EC₅₀ for reporter gene induction increased with greater concentrations of MNF, thus indicating antagonistic properties of MNF. However, MNF alone at high (5µM) concentrations induced a greater amount of fluorescence than solvent alone, indicating agonistic properties as well. As measured by real time RT-PCR, endogenous gene expression in H1G1.1 mouse cells treated with MNF (5µM) or MNF + TCDD was significantly less than those treated with TCDD and greater than solvent alone. The antagonistic properties of MNF were maximized while minimizing its agonistic properties at a concentration of 1µM. Future research on MNF and its mediation of toxicity of other AHR agonists should utilize 1µM concentrations.

- P47 PILLAI LAKSHMI R, LAKSHMI PULAKAT AND NARA GAVINI. Mississippi State University—Studies on interaction between the Insulin Receptor and the fourth Melanocortin Receptor, MC4R.

Development of Insulin Resistance in Obesity is an added risk factor. Inability of Insulin Receptor (IR) to respond to Insulin is the underlying cause of Insulin Resistance. The fourth Melanocortin Receptor (MC4R) is a G-protein coupled receptor that is expressed primarily in the brain. The MC4R is known to be involved in energy uptake and metabolism and alterations in its function is known to promote obesity and other associated abnormalities. Also important in fuel metabolism is signaling in the brain via the IR. The purpose of this study was to ascertain if signal transduction by IR is affected in any way by the MC4R during obesity. Yeast two-hybrid vectors pGBTK7 (bait) and pGAD424 (prey), were used to generate translational fusions carrying either full length or truncated beta subunit of IR with Gal4 DNA-binding domain (GAL4BD) and Gal4 activation domain (GAL4AD). Similarly GAL4BD and GAL4AD were also translationally fused to full length and truncated MC4R. Reporter yeast strains CG1945 and Y190 were co-transformed with different combinations of bait and prey plasmids and the ability of the IR and MC4R to interact was assessed by testing the ability of the transformants to grow on Trp⁻Leu⁻His⁻ plates and express beta-galactosidase. Varying levels of interaction between the full-length beta subunit of IR and the truncated MC4R constructs were seen. These results imply that interaction exists between the IR and the MC4R. This could have far reaching implications in the treatment of Insulin Resistance and Obesity.

- P48 PULLEN, MATTHEW AND MARGARET KOVACH, Ph.D University of Tennessee at Chattanooga—Comparative rates of nDNA degradation using rat models in eastern Tennessee.

Criminal investigations often use DNA evidence to identify both deceased individuals and suspects in crimes. Due to the importance of this use, ensuring the quality of this DNA despite its exposure to the environment is imperative. The rates of degradation in two short tandem repeat sequences in nuclear DNA (nDNA) located on chromosomes 1 and 20 were measured in Sprague-Dawley rat models placed in varied environments of eastern Tennessee. The environments included a wooded area, submerged in a pond, and in a simulated arid environment. The rats were placed in their respective environments and allowed to decompose undisturbed except for routine nDNA collection every two days. These samples consisted of skin and hair taken from comparable areas of each rat. At the conclusion of collection, the DNA from these samples were extracted, amplified with polymerase chain reaction technology, and analyzed via gel electrophoresis. The rates of bacterial and insect activity were directly correlated with the degradation of nDNA in soft tissue. The analysis of these samples should help provide a narrower view of the usefulness of nDNA in the legal aspect of DNA identification separate from mtDNA.

- P49 RAMDAS, MAYA; NARA GAVINI AND LAKSHMIDEVI PULAKAT. Mississippi State University—Angiotensin receptor AT2 directly interacts with insulin receptor (IR) in yeast two hybrid assay.

Receptor tyrosine kinases are a super family of proteins that contain an extra cellular ligand domain and intracellular tyrosine kinase domain (ErbB3, and IR). We have previously shown that the Angiotensin 2 (AT2) receptor and the ATP-binding domain of ErbB3 interact in a yeast two-hybrid system. The AT2 receptor plays a major role in growth regulation; it has been shown to inhibit cell growth and induce apoptosis, whereas ErbB3 is a stimulator of growth. Since the ATP-binding domain of the insulin receptor (IR) is structurally similar to that of the ErbB3 receptor, we hypothesized that AT2 receptor may interact with the beta subunit of IR, where the tyrosine kinase activity is located. To test this idea, the full length beta subunit of IR (1863 base pairs) and a sub-fragment of IR beta subunit (1092 base pairs) were each transitionally fused to a Gal4 DNA activation domain, present in the yeast two-hybrid bait vector pGAD424. It has already been demonstrated that the AT2 receptor used to study ErbB3 interaction spanned the amino acids from 226-363, which forms the third intracellular loop in the cytoplasmic domain. The AT2 receptor construct was fused to the Gal4 DNA binding domain of the prey vector pGBK7. Our analysis indicated that the full-length beta subunit of IR interacted with the AT2 receptor in a similar fashion as that of ErbB3. Transformations were done using the yeast strain CG1945, and the interactions were demonstrated using a beta-galactosidase assay. These experiments suggest that the cytoplasmic domain of the AT2 receptor might be involved in interaction with the ATP binding site of IR, providing a strong link between diabetes and hypertension.

- P50 ROGERS, CARLYLE AND JOHN W. STILLER. East Carolina University—Effects of seven alanine insertions between diheptapeptides of the RNAP II C-Terminal Domain (CTD).

The C-terminal domain (CTD) of the largest subunit in DNA-dependent RNA polymerase II (RNAPII) is known to be essential for mRNA syntheses in animals and yeast. In yeast a minimal of eight heptads with the consensus sequence of Y-S-P-T-S-P-S must be present for viability. Previous research has shown that the essential unit of function of the CTD is present in pairs of these heptapeptide repeats, or diheptads. Mutational studies have demonstrated that separating diheptads by increasing numbers of alanine residues has a quantitative rather than a qualitative effect. Two alanine residues between diheptads results in slower growth than does one alanine. With five alanine insertions, further growth deterioration is observed compared to shorter disruptions. Here we address the question of whether insertions of 7 alanines, which return diheptads to their normal spacing in the CTD, result in improved growth relative to a 5 alanines, or whether they are even more deleterious. An improvement of function in 7A versus 5A mutants would support the hypothesis that diheptads function independently but that their occurrence in a global seven amino acid repetitive structure is important

- P51 SHIVAJI, SANGEETHA, KUMARAGURU RAJA, LAKSHMIDEVI PULUKAT AND NARASAIAH GAVINI. Mississippi State University—Functional analysis of the ORF10 in the nif gene cluster of Azotobacter vinelandii.

The transition metal molybdenum is essential for life. Molybdenum-containing enzymes catalyze basic metabolic reactions in the nitrogen, sulfur, and carbon cycles. Dinitrogenase, a protein central to nitrogen fixation, is a molybdoenzyme. The process of nitrogen fixation in *Azotobacter vinelandii* requires about 15 *nif* genes, which are clustered together in the genome, occurring as the *nif* regulon. Twelve other potential genes, or ORFs, whose expression are potentially subjected to *nif*-specific regulation are also found interspersed among the identified *nif*-specific genes. ORF10 of the *nif* gene cluster is of particular interest; it encodes a 358 amino acid protein [39.6 kDa] highly similar to the product of another gene called *modC* that is involved in molybdate transport. The molybdate transport system in *A. vinelandii* is composed of a periplasmic binding protein, a membrane protein, and an ATPase that supplies energy for transport; these are

encoded by the *modABC* genes respectively. The *mod* operon also includes *modE*, whose product acts as a molybdate-dependent regulator of several operons. Analysis of the ORF10 promoter to elucidate its regulation revealed an organization of transcriptional regulatory sites including a ModE binding consensus sequence, an Integration Host Factor binding site, two NifA binding sites and a RpoN binding site. NifA and RpoN are both genes involved in the regulation of the *nif* regulon in response to nitrogen availability. These observations imply that disruption of the coding region of the ORF10 by the insertion of a Kan^R gene would affect the diazotrophic growth of *Azotobacter vinelandii* under molybdenum limiting conditions.

- P52 VANDERBUSH, NICOLE¹ AND DAN DAVIS². Shorter College¹ and University of Arkansas²—The Effect of Mutations at Positions 160 and 156 on the Redox Potentials of *Chlamydomonas reinhardtii* Cytochrome f.

Chlamydomonas reinhardtii cytochrome f is known to have two propionate groups in its heme structure. The interaction of one of these groups with residues Y160 and R156 was investigated through a series of mutagenesis studies. Redox potentials were measured for mutants of Y160. The Y160L mutant reduced the redox potentials by ≈ 35mV whereas the Y160F mutant retained redox values similar to that of the wild type. The Y160L mutant removed both the hydrogen bonding capability of the residue and the aromaticity. The Y160F mutant left the aromaticity intact and removed the hydrogen bonding capability of the residue. Because of the change in redox potentials in the Y160L mutant that are not present in the Y160F mutant, it is surmised that the aromatic character of the residue is what needs to be retained to maintain redox potentials of the wild type. The R156L mutant that was made was air oxidizable and did not allow for accurate measurements of its redox potential. The interaction between the R156 residue and the propionate group of the heme is necessary for the stabilization of the protein.

- P53 WARNER, CHARLENE AND MIN-KEN LIAO. Furman University—Comparison of the genetic polymorphisms of Bunched Arrowhead (*Sagittaria fasciculata*) populations in different watersheds.

After appearing on the endangered species list on July 25, 1979, the desire to learn more about Bunched Arrowhead (*Sagittaria fasciculata*) increased as the conservation campaign began. The Bunched Arrowhead is able to reproduce sexually and asexually. This results in populations exhibiting varying levels of genetic diversity that is difficult to distinguish by examining their morphology. In the past few years, we streamlined a reliable procedure called ISSR (inter-simple sequence repeat) to assess the genetic diversity of different Bunched Arrowhead populations. We analyzed ISSR results using the Phoretix 1D Advanced and 1D Database developed by Nonlinear Dynamics. The software allows us to quickly generate dendograms of relatedness and to accurately assess the genetic diversity of the populations. The major goal of this study was to use these techniques to compare the genetic diversity of different Bunched Arrowhead populations in different watersheds. We hypothesized that populations within the same watershed would be genetically similar. In addition, nearby populations should share more genetic similarity than distant populations. We have thus far processed 70 samples collected from the Enoree and Reedy Rivers. We are able to visually display the locations of our study populations to compare their genetic polymorphisms using the Geographical Information System (GIS). Our preliminary analysis of the ISSR results using Nonlinear Dynamics software suggested that populations in the same watershed indeed share greater genetic similarity. We are in the process of analyzing whether the genetic similarity decreases as the distance between the populations increases.

- P54 WINDHAM, MARY AND JOHN W. STILLER. East Carolina University—Mutational length analyses of the RNA polymerase II C-terminal domain.

The C-terminal Domain (CTD) of RNA Polymerase II binds essential transcription-related proteins that initiate and guide the synthesis of messenger RNA. The CTD is composed of tandemly repeated heptapeptides with a consensus sequence YSPTSPS. Normally yeast have 26 repeats of the YSPTSPS heptapeptide but display wild-type growth with only 13

repeats present. We mutated CTD sequences to contain three alanines (3AR) in place of the last three peptides of every other heptapeptide (YSPTSPSYSPATAA). A series of different yeast mutants were constructed with varying numbers of 3AR diheptad repeats. All mutant growth rates were lower than wild-type, and those with fewer than 6 mutated 3AR diheptad repeats were not viable. However, mutant yeast growth rates increased consistently with increasing length of the repeated 3AR sequence, similar to other non-lethal CTD mutations studied previously. Our research objective is to understand the reason yeast retain 26 CTD heptapeptides, even though the same growth patterns are attained when only 13 repeats are present. Observing growth patterns of yeast 3AR mutants with varied lengths, ranging from 12 to over 30 unit repeats, will allow us to determine whether mutated CTDs continue to improve transcriptional function beyond the normal length of the wild-type CTD. The combined data from growth experiments and graphical analysis will provide insights into possible cryptic differences in function that are responsible for maintenance of more heptapeptide repeats than appear to be needed.

Herpetology

- P55 ABERCROMBIE, VICTOR¹, RICKY FIORILLO¹ AND BILL LUTTERSCHMIDT². Shorter College¹ and Sam Houston State University²—Habitat characteristics and movement of Copperhead, *Agristodon contortrix*.

In April-May 2004, three adult Copperhead, *Agristodon contortrix* were captured at the base of Rock Mountain, in a rural area of Floyd County, in Northwest Georgia. Each snake was surgically implanted with an AVM Instrument Co. G3-1V, 1.55 volt transmitter. Individuals were released June 6, 2004 at their site of capture on property owned by Mr. Claude Abercrombie and tracked through September 2004 with an AVM Instrument Co. LA12-DS Portable Telemetry Receiver. Each individual was located every 2 days between 1600-1800h, and at each sighting, we mapped location with GPS and measured air and substrate temperature, and canopy cover. At each encounter a digital photo of each individual centered with a meter stick for area size reference was taken to characterized a 1 m² area of substrate as percent leaf litter, live vegetation, and woody debris. Although one individual was never found, individuals two and three were located 20 and 40 times, respectively. Overall, these snakes were found mostly under dense canopy in areas containing 50% or more leaf litter. Both individual had small (~1.2 hectares) home ranges that showed considerable overlap but were never found less than 150 m apart. In addition, these individuals showed an affinity for man-made structures, possibly because of high prey density (rodents, lizards etc.) and were found mostly within 3 m or less of a home, barn, woodpile, garden or driveway.

- P56 BALDWIN, TIMOTHY E.¹, MATTHEW R. GRAHAM¹, MARK B. WATSON² AND THOMAS K. PAULEY¹. Marshall University¹ and University of Charleston West Virginia²—Herpetofaunal species richness of four West Virginia national parks.

West Virginia, with five physiographic provinces, is known for its abundance of herpetofauna. National parks provide areas for these animals to exist with minimal anthropomorphic disturbances, but to monitor and protect these animals habitats need to be inventoried. Using a variety of techniques, we conducted day and night inventories in 4 West Virginia national parks. These national parks included New River Gorge National River (NERI), Bluestone National Scenic River (BLUE), Harpers Ferry National Historic Park (HAFE), and Gauley River National Recreational Area (GARI). We verified the presence of native species of amphibians and reptiles to gain a better understanding of life histories and to make conservation efforts more effective. It is the goal of the National Park Service to find 90% or more of potential species in national parks. Based on the potential species list, the percentage of amphibian species found during inventories was 83.9% for GARI, 80.0% for BLUE, 60.6% for NERI, and 72.0% for HAFE. The percentage of reptile species found in each park was 70.4% for GARI, 44.4% for BLUE, 66.7% for NERI, and 50.0% for HAFE. The results of this study give us a better understanding of the reptile and amphibian communities within the national parks of West Virginia. This will allow for more informed management decisions in the future.

- P57 BOND, TRISTAN J., DANIEL WARE AND THOMAS K. PAULEY. Marshall University—Use of leaf litter bags as a capture technique for long-term stream salamander studies.

Leaf litter bags, or refugia bags, are useful as a technique to capture stream salamanders, particularly larval and juvenile stages. They provide a desirable capture technique because they are nondestructive, inexpensive, less time consuming than quadrat and transect searches, and they solve the problem of capturing tiny, difficult-to-find larvae. Leaf litter bags are constructed by cutting 50 x 30 cm sections of 3-4 cm mesh size plastic netting and placing small rocks in the bottom of the bag, then filling them with leaves and tying the top closed. This technique originated from T. K. Pauley and M. Little of Marshall University after their experiences working with aquatic invertebrate biologists who reported finding many larval and juvenile salamanders in leaf packs in streams. Here we present the longest known study to test the effectiveness of refugia bags. This technique was used as part of 2 different studies monitoring the residual effects of pesticides targeted for gypsy moths. The first study involved 5 streams in the Fernow Experimental Forest at Parsons, WV from 1989 to 1994, and the second study was conducted from 1997 to 2001 on 9 streams in the Monongahela National Forest in Pocahontas County, WV. Both studies took place from May through October and produced 2,025 salamanders of 5 different species. This study demonstrates that leaf litter bags are a simple and effective method for long-term studies of stream salamanders that include natural history and relative abundance.

- P58 CECALA, KRISTEN K., STEVEN J. PRICE, MICHAEL E. DORCAS. Davidson College—The effects of urbanization on stream salamanders: Initiation of a landscape-level experiment.

The Charlotte, North Carolina metropolitan area contains one of the nation's fastest growing human populations, and urban sprawl is quickly expanding into the Piedmont forested lands. Amphibians are particularly vulnerable to landscape-scale habitat destruction, especially when roads, neighborhoods, and shopping centers dissect and degrade previously intact habitat. Previous research showed that stream salamander abundance was negatively correlated to the percentage of disturbed (e.g., urban) land within watersheds of first-order streams; however the proximate mechanisms resulting in this reduced abundance are unknown. Therefore, we are performing a multi-year, landscape-scale experiment in the Charlotte metropolitan area to: 1) investigate how the relative abundance of stream salamanders change as stream watersheds undergo urbanization, 2) examine the ability of adult salamanders to persist in disturbed stream habitats and, 3) explore other sub-lethal stressors that impact salamanders in urbanized watersheds. Currently, we have captured over 2,100 salamanders of 6 different species, including *Desmognathus fuscus*, *Eurycea cirrigera*, *Eurycea guttolineata*, *Gyrinophilus porphyriticus*, *Pseudotriton montanus*, and *Pseudotriton ruber* and have used visible fluorescent implant elastomers to uniquely mark 300 salamanders. Preliminary results of development on stream salamander populations indicate that declines may have occurred, however future analyses are needed to clarify these findings. Additionally, we have found several *D. fuscus* heavily infested with parasites initially identified within the order Acari, which may be an important sub-lethal stressor on Piedmont salamander populations. We will continue to monitor salamander abundance and habitat condition during and after watershed development.

- P59 CHASE, KODY, VICTOR ABERCROMBIE, COREY O'CONNOR, ZACK BURKHALTER, SARAH GARDNER AND RICKY FIORILLO. Shorter College—Amphibian breeding phenology and reproductive ecology of *Ambystoma opacum* in a seasonal pond in Marshall Forest, Rome, Georgia.

Temporary ponds are crucial breeding habitat for many amphibians. In January 2004, we began monitoring, with a drift fence and pitfall traps, a small seasonal pond in Marshall Forest, a 311 ac. Nature Conservancy preserve in Rome, GA. As of October 2005, we have collected 660 individuals representing 12 species of amphibians. This site has been

monitored through three wet periods (JAN—APR '04; NOV '04—MAY '05; JUL 05). Overall amphibian abundance is greatest in February of both years, mostly because of winter breeding *Pseudacris triseriata* and *P. crucifer*, while species richness and diversity peaks in March of both years. *Ambystoma opacum* is the most common salamander and a fall aggregate breeder. Recapture data suggests that most females remain on their nest until the pond is flooded, while males are recaptured leaving the pond soon after the first females arrive and well prior to pond flooding. Reproductive investment is high as recaptured males leaving the pond lost $12.8\% \pm 9.8$ of body weight, while recaptured females weighed $29.6\% \pm 4.8$ less than when they arrived. Here we report data on amphibian breeding phenology and on the reproductive ecology of *A. opacum* including pattern of migration, adult body size, pond residency time, reproductive investment and time and body size at metamorphosis.

- P60 FAILEY, ELISABETH L, JOHN C. MCCOY, STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—Ecology of turtles inhabiting golf course and farm ponds in the Western Piedmont of North Carolina.

Urbanization and land alteration are anthropogenic factors frequently associated with turtle population declines. Golf courses represent an important form of land alteration, yet our understanding of reptile populations inhabiting golf courses is limited. We conducted a comparative ecology study of turtles inhabiting 5 golf course and 5 farm ponds in the western Piedmont of North Carolina from 17 April 2005 to the 28 July 2005. We examined the effects of surrounding habitat within a 500 m pond radius of each pond and pond size on painted turtle (*Chrysemys picta*), common snapping turtle (*Chelydra serpentina*), yellowbelly slider (*Trachemys scripta*) and mud turtle (*Kinosternon subrubrum*) abundances. We also assessed relative species richness, species abundances, size distributions, sex ratios and body condition between habitat types. In total we captured 248 *C. picta*, 43 *C. serpentina*, 86 *T. scripta*, and 28 *K. subrubrum*. We captured more *K. subrubrum* when roads were located farther from ponds ($p = 0.05$), more *C. picta* in ponds with a higher percentage of surrounding unforested habitat ($p < 0.05$) and a greater number of *C. serpentina* and *C. picta* in larger ponds ($p = 0.01$ and $p = 0.05$, respectively). Relative species abundances, size distributions for each sex and sex ratios were not distinguishable between the two pond types, although *C. picta* from golf course ponds had higher condition indices than those from farm ponds ($p < 0.01$). Thus, it appears that both farm pond and golf course habitats provide suitable habitat for several species of semi-aquatic turtles.

- P61 FISHER, ASHLEY R.¹, W. ROBERT GORDON² AND THOMAS K. PAULEY¹. Marshall University¹ and West Liberty State College²—Turtle assemblages in the eastern panhandle of West Virginia with an emphasis on the distribution of *Pseudemys rubriventris*.

Little is known about turtle assemblages in West Virginia especially in the eastern panhandle. Marshall University does most of the herpetological research in the state and the eastern panhandle has been neglected because of its great distance from the university. The range of *Pseudemys rubriventris* includes the Coastal Plain Rivers of the mid-Atlantic region, from northern North Carolina to central New Jersey. In West Virginia, they inhabit the Ridge and Valley region, which differs from the Coastal Plains because this is the only mountainous environment where they are known to reside. During 2005, we trapped to demonstrate turtle assemblages in this area. Twenty-two trap nights with 10 traps per night yielded *Pseudemys rubriventris* in 3 of the 5 counties trapped. In addition to *P. rubriventris*, 5 other turtles were observed including *Chrysemys picta*, (the most common), *Chelydra s. serpentina*, *Sternotherus odoratus*, and *Glyptemys insculpta*.

- P62 JENNISON, CHAD A.¹, SHANNON E. PITTMAN², STEVEN J. PRICE², AND MICHAEL E. DORCAS². The University of Georgia¹ and Davidson College²—Activity, growth, and survivorship of post-metamorphic Fowler's toads (*Bufo fowleri*) in different habitats.

The conversion of forested land to agricultural or urban land may have significant affects on the amphibian populations. Additionally, edge effects, such as increased soil and air temperature and decreased humidity, may extend considerable distances into undeveloped forest and impact amphibians living in habitat edges. Our objective was to determine the effect of habitat alteration on the activity, growth, and survivorship of Fowler's toads (*Bufo fowleri*). We constructed a set of three 2X2 m enclosures in four different habitats: 15m from a forest edge into a field, the edge forest-field interface, and 15m and 30m into a forest. We seeded each enclosure with 20 recently metamorphosed *B. fowleri* and measured activity, growth and survivorship over a three-week period by pitfall trapping within the enclosures. We found that activity in the field was lower than in the other habitat types ($p < 0.05$) and that activity decreased over time in all habitats ($p < 0.01$). Growth was most rapid in the edge, followed by both forest plots and then the field. Survivorship decreased in all habitats during the study period ($p < 0.05$) however, fewer toads survived in the field than in the edge or forested habitats ($p < 0.05$). These results suggest that juvenile Fowler's toads are sensitive to cleared habitat, which provides limited refuge from heat or desiccation. Conversely, edge habitat appears to be suitable for toads, which may explain their ubiquity in suburban and urbanized regions of the southeastern United States.

- P63 KEITZER, S. CONOR¹, THOMAS K. PAULEY¹, AND MARK B. WATSON². Marshall University¹ and University of Charleston²—Effectiveness of coverboards for monitoring terrestrial salamander species in relation to slope aspect, elevation, and physiographic region.

The cryptic nature and long life spans of many terrestrial species of salamanders can make it difficult to determine species diversity and to monitor the status of populations. Use of artificial cover objects, or coverboards, is one technique commonly utilized to survey terrestrial salamanders. Data from two long-term studies of salamander species in mixed deciduous forests of central Appalachia were collected to determine the effectiveness of coverboards as a sampling method in relation to elevation, physiographic province, and slope aspect. A study of 3 watersheds in the Fernow Experimental Forest from 1989-1994 employed coverboards of different sizes (20 cm x 10 cm x 1.3-2.5 cm to 175 cm x 23 cm x 1.9 cm) along two 100 m horizontal transects. A second study was conducted in the Monongahela National Forest from 1995-2001 where coverboards (15 cm x 8 cm x 2.5 cm) were arranged in a 3 by 4 matrix every ten meters along 100 m vertical transects. Salamander species abundance and environmental data (soil temperature, soil moisture, air temperature, and air relative humidity) were recorded at each site. Preliminary results indicate that coverboards were effective in detecting the majority of terrestrial species present in the Monongahela National Forest and Fernow Experimental Forest, with *Plethodon cinereus* being the most frequently encountered species. Further data analysis will be conducted in order to determine the effectiveness of coverboards in relation to slope aspect, elevation, and physiographic region.

- P64 KIRLIN, MICHELLE S., MICHELLE M. GOOCH, STEVEN J. PRICE, AND MICHAEL E. DORCAS. Davidson College—Predictors of Winter Anuran Calling Activity in the North Carolina Piedmont.

Global amphibian declines have created an urgent need to monitor populations. Anuran calling surveys are a widely used and accepted monitoring technique, however habitat and weather variables influence anurans breeding distribution and timing and need to be considered when establishing monitoring programs. In this study, we investigated the effects of both habitat and weather variables on detection probabilities and site occupancy estimates of winter-breeding anurans in the western Piedmont of North Carolina. We conducted calling surveys at 27 ponds in Mecklenburg County, NC and used the program PRESENCE to evaluate how anuran detectability and site occupancy estimates were influenced by habitat type surrounding the pond and weather variables. We determined the best-fit model for each of the three species we observed. Upland chorus frog calling activity (*Pseudacris feriarum*) was best predicted by distance to nearest road and air temperature, spring peeper calling activity (*Pseudacris crucifer*) was best predicted by

precipitation, and southern leopard frog calling activity (*Rana sphenocephala*) was best predicted by day of the year. Our results indicate that species' calling activities vary according to different habitat and weather variables. Models that incorporate these variables to describe anuran calling behavior can be used by monitoring programs to design species-specific survey protocols.

- P65 NIEMILLER, MATTHEW L., BRAD M. GLORIOSO, AND BRIAN T. MILLER. Middle Tennessee State University—Status and distribution of the streamside salamander, *Ambystoma barbouri*, in middle Tennessee.

Populations of the Streamside Salamander, *Ambystoma barbouri*, in Middle Tennessee delimit the southern extent of the species range and are geographically isolated from more northerly located populations. Few populations have been discovered in Tennessee, and all of them are located in the Inner Nashville Basin ecological subregion of the Interior Plateau. We surveyed for breeding activity (presence of eggs, larvae, and adults in breeding condition) in first- and second-order streams in the southern portion of the Inner Nashville Basin to better determine the species distribution and to examine the status of and existing threats to extant populations. Streamside Salamanders were observed at five of 40 localities surveyed in southern Rutherford, northern Bedford, and northeastern Marshall County. Additionally, *A. barbouri* was confirmed at only 4 of 6 known breeding sites. Continued habitat fragmentation and alteration in association with the urbanization of Rutherford County threaten existing *A. barbouri* populations. These populations may represent the last remaining populations in the state. Existing populations should be monitored to document population changes on an annual basis, and further research should be conducted to determine reproductive output and survivability of eggs and larvae. Efforts should also be made by both state and local agencies to preserve and improve first- and second-order breeding sites, and the surrounding forests used by adult Streamside Salamanders.

- P66 RENTERIA, ROBIN, RICCARDO FIORILLO, KODY CHASE AND THOMAS MCELROY. Kennesaw State University—Genetic structure and parentage analysis of the marble salamander, *Ambystoma opacum*, in Marshal Forest, Rome, GA.

There are many factors leading to the unprecedented worldwide decline in the amphibian populations; the most obvious factors being habitat destruction and alterations such as clear cutting and draining of wetlands. Other factors include disease, global environmental change, as well as other contaminants. Due to amphibians having permeable skin and a biphasic life-cycle they are more sensitive to environmental disturbance which makes amphibians a good indicator species for assessing environmental quality. One good method for determining the overall diversity and population health in amphibians is to monitor their breeding sites. Since December of 2003 Dr. Tom McElroy and Dr. Ricky Fiorillo have monitored a vernal pond in Marshall Forest which serves as a breeding site for many amphibians, including the Marble salamander. Adult male and female salamanders will be captured as they enter and leave the pond, along with the juveniles as they leave in late spring. The parental analysis and genetic structuring is expected to indicate a general skew in reproduction of these amphibians. A survey of 3 polymorphic microsatellite loci for *A. opacum* was performed. The microsatellite were amplified using PCR. The amplified products were electrophoresed on an ABI 310 automated DNA sequencer. Analysis of allele frequencies will determine feasibility and power of parentage analysis with the microsatellite loci that are surveyed. Critical values will be calculated in order to determine confidence levels in parentage.

- P67 WARDEN, MELISSA AND SHERRY BANKS. Augusta State University—A soft release protocol for juvenile gopher tortoises (*Gopherus polyphemus*) Daudin

The gopher tortoise (*Gopherus polyphemus*) Daudin is listed as a threatened species in the state of Georgia. In 1999, the McDuffie Public Fishing Area, McDuffie County, Georgia, was designated by the Department of Natural Resources as the state's relocation site for waif tortoises. Thirteen adults have been relocated. Since 2000, eight

offspring have been found at the site. We compared body weight and height, width and length of the carapace in captive-raised, juvenile tortoises with those that were reared in an enclosure for 111 days. Weight and height of the carapace decreased in all five enclosure-reared tortoises but width and length of the carapace decreased in only two of the five. Tortoises that were captive-reared showed the greatest percent increase in weight and there was no difference between the percent increase in length and width of the carapace. Height of the carapace increased the least in the captive-reared tortoises.

- P68 MCCOY, JOHN C., ELISABETH L. FAILEY, STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—An assessment of leech parasitism on semi-aquatic turtles in the western Piedmont of North Carolina.

During the summer of 2005, we assessed the occurrence of leeches on semi-aquatic turtles in five farm ponds and four golf course ponds in the western Piedmont of North Carolina. *Placobdella parasitica* was the only species of leech found to parasitize turtles and was present on turtles from all study ponds. Female painted turtles (*Chrysemys picta*) were more frequently parasitized than males (females 54.7%, males 40.9%; p= 0.039), possibly because they are larger and provide more surface on which leeches can attach. Common snapping turtles (*Chelydra serpentina*) had the highest leech load of any species (mean = 32.3 per turtle) which we attribute to its relatively large size, reduced plastron size and bottom-dwelling habits. We found no relationship between the parasite load and body condition of turtles. Overall, there were no differences in mean leech load between the two pond types. However, *C. serpentina* were parasitized more heavily in farm ponds (p < 0.001) while *C. picta* were parasitized more heavily in golf course ponds (p = 0.02). Most leeches were found attached to the underside of the marginal scutes or between the plastron and inguinal region. These sites most likely offer the most protection from the environment when the turtle emerges from the water.

- P69 PITTMAN, SHANNON AND MICHAEL DORCAS. Davidson College—The Catawba River Corridor Coverboard Program: a citizen science approach to amphibian and reptile inventory.

Coverboards are a useful inventory tool for many species of amphibians and reptiles and they provide a simple and effective method to involve the public in scientific research. In 2003, the Davidson College Catawba River Corridor Program (CRCCP) was initiated to help coordinate the efforts of public and private sectors in surveying amphibians and reptiles. Fourteen sites were established within the Catawba River Corridor in North and South Carolina. Participants included schools, private industry, and locally-operated nature preserves. The Davidson College Herpetology Laboratory and Duke Power Environmental Laboratory helped set out coverboards at each site. The CRCCP website provided participants with assistance in species identification, protocols and online datasheets. Between 2003 and 2005, a total of 37 species was documented, including 17 species of amphibians and 20 species of reptiles. Coverboards proved more effective for inventory of salamanders and lizards (47% and 48%, respectively of within-range species), and less effective for anurans, snakes, and turtles (34%, 35%, and 24%, respectively of within-range species). As a whole, schools submitted data more consistently than nature preserves or private industry, but more species were detected on nature preserves (32 species). The CRCCP provided the opportunity for many people, including numerous school children, to become involved in scientific research. Although acceptance of species identification necessitates caution without voucher photographs, the program has added significantly to our knowledge of the distributions of amphibians and reptiles in the region. Data collected through the CRCCP are essential to the development of effective monitoring programs and conservation measures.

Ichthyology

- P70 KOKKALA, IRENE¹, CHRISTINA J. CINI¹, JACKELYN M. CRABTREE¹, AND STEPHEN J. WALSH². ¹North Georgia College & State University and ²U.S. Geological Survey—Histology and survey of the juxtapatesticular body in eight species of jawfishes, family Opistognathidae.

The unpaired juxtesticular body (JTB) is a small, ovoid organ in male jawfishes, family Opistognathidae. The JTB typically ranges in diameter from 1-6 mm, lies outside the coelomic cavity, is of nephrogenic origin, lies posteroventral to the kidney, dorsal to the urinary bladder, and is flanked by the testes. The ductless tissue consists of a highly vascularized arrangement of follicles similar in nature to the vertebrate thyroid gland. Based on cytological and histochemical characteristics and its sexually dimorphic occurrence, the JTB is inferred to be secretory and putatively involved in reproduction, yet its function is unknown. The JTB has previously been documented in five jawfish species, all of the genus *Opistognathus* (*O. aurifrons*, *O. leprocarus*, *O. macrognathus*, *O. maxillosus*, and *O. whitehurstii*). We examined museum specimens of eight species of jawfishes for the presence of the JTB, to further document taxonomic diversity of its occurrence and in an effort to determine if this structure represents a possibly synapomorphy for the family. Samples were mounted in hydroxyethyl methacrylate using a JB-4 embedding kit, sectioned at 1-2 microns, and stained with toluidine blue. Species studied included *Lonchopisthus micro*, *L. lemur*, *L. micrognathus*, *Opistognathus leprocarus*, *O. robinsi*, *O. darwinensis*, *O. latitabunda*, *Stalix moenensis*. Additional studies are required to further evaluate the taxonomic distribution of the JTB, as well as to fully characterize its structure and determine its function.

P71 STEELY, CHELSEA, WILLIAM ENSIGN AND THOMAS MCELROY. Kennesaw State University—Genetic characterization of the stone roller (*Campostoma oligolepis*) in the Euharlee creek system.

The analysis of genetic variation within and among populations is important because it allows us to understand the factors driving evolutionary change. Patterns of genetic variation among populations can be used to investigate connectivity among sites. We studied several populations of *Campostoma oligolepis*, a species of fish in the minnow family. We determined if they exhibit significant population genetic structure among creek sites. Samples of *C. oligolepis* were collected from three different tributaries branching off the Euharlee Creek system in northern Georgia, USA. A twenty-five milligram portion of muscle tissue was then removed from each sample and the DNA was extracted. The Polymerase Chain Reaction was then run on the samples in order to amplify several microsatellite loci located within the nuclear genome. The microsatellite fragments were analyzed on an ABI 310 Genetic Analyzer. These data allowed us to genetically characterize populations within and among collection sites. Gene flow among the sampled sites was estimated in order to determine if barriers to gene flow may exist.

P72 THOMASON, KATHERINE, JENNIFER McCABE, SANDY MARSHALL, BRADLEY RICHARDS, JOHN WORTHEN AND MIN-KEN LIAO. Furman University—Isolation and characterization of tetracycline-resistant *Escherichia coli* in Furman Lake.

As a normal inhabitant of the gastrointestinal microbiota, *Escherichia coli* has been used as an indicator of human and animal activity in a water body. High concentrations of *E. coli* represent a high risk to public health; moreover, the presence of antibiotic-resistant bacteria in the environment represents an even greater risk. Hence, in this study, we focused on the isolation and characterization of tetracycline-resistant *E. coli* in Furman Lake. We hypothesized that we would have a genetically diverse collection of tetracycline-resistant *E. coli* strains because (1) there is mass abuse of tetracycline medicinally and agriculturally that should select for tetracycline-resistant *E. coli* strains, and (2) Furman Lake hosts an abundant population of birds. We isolated and genetically typed 57 tetracycline-resistant *E. coli* strains. One third of these isolates proved capable of transferring the tetracycline-resistant trait via conjugation. The Kirby-Bauer method was employed to determine the antibiotic-resistant profiles of all the *E. coli* isolates. Another approach was to determine how these tetracycline-resistant *E. coli* strains arose. We developed a technique capable of detecting concentrations greater than 25 nanomoles of tetracycline in water and assayed the water. Furman Lake was found not to contain detectable concentrations of tetracycline. Hence, we tentatively concluded that the selective pressure for the resistance trait exists outside the Lake and our *E. coli* isolates

were introduced to the Lake already possessing the trait. Future study will focus on the characterization of the transferable unit containing the tetracycline-resistant trait.

- P73 WEBB, CLIFFORD J. AND CLINE, GEORGE Jacksonville State University—Diet Study of Two Species of Demersal Fish Predators (*Synodus poeyi* and *Synodus foetens*).

The Offshore Lizardfish (*Synodus poeyi*) is a demersal predator up to 25cm long. It is reef-associated, marine and found at depths ranging from 27-320m. Its range is subtropical in the Western Atlantic from N.Carolina, U.S.A. and the northern Gulf of Mexico to the Antilles and the Guianas. The Inshore Lizardfish (*Synodus foetens*) is also a demersal predator up to 48cm long. It is reef-associated in marine and brackish waters at depths from 0-200m. Its range is the Western Atlantic from Massachusetts, U.S.A. and the northern Gulf of Mexico to Brazil. All specimens were caught from 10/04-11/04 in trawls of the northern Gulf of Mexico off the coast of the U.S.A. from Mississippi to Central Florida aboard two NOAA (National Oceanic Atmospheric Administration) vessels: The Gordon Gunter and The Oregon. Standard towing time was 30 minutes at depths from 30-230m. Jaw length, fork length, head width and snout to caudal peduncle measurements were taken. Stomachs were removed and their contents examined. Typical food items for *S.poeyi* included Crustaceans, Cephalopods and various fish. Out of 45 *S.poeyi* examined four had empty stomachs. Typical food items for *S.foetens* included Cephalopods and larger fish (up to 128mm in length) but no crustaceans. Out of 40 *S.foetens* examined 20 had empty stomachs. *S.poeyi* food items typically were smaller and contained more pieces of invertebrates. Typically only 1-2 taxa were in each stomach. *S.foetens* food items were sometimes almost half the length of the fish with an average of one taxon represented in each stomach.

Invertebrate Zoology

- P74 BURNS, JESSICA A.¹, VICTOR R. TOWNSEND, JR¹, DANIEL N. PROUD¹, JESSICA A. TIBBETTS¹, REBECCA K. HUNTER¹, AND MICHAEL K. MOORE². Virginia Wesleyan College¹ and Mercer University²—Observations of parental care in the neotropical harvestmen *Phareicranaus calcariferus* (Opiliones, Cranaidae) from Trinidad, W. I.

The ecology of most species of neotropical harvestmen is poorly known. In harvestmen, parental care may take the form of egg guarding, egg-hiding, egg transport, or young guarding. For most species in the suborder Laniatores, maternal care is most common. However, observations of paternal and biparental care have been made for several species. In this study, we report observations of maternal and possibly biparental care of young in the harvestmen *Phareicranaus calcariferus*. From 9 July to 5 August 2005, we studied the biology of this species in the rainforests of the Northern Range of Trinidad, West Indies. Our observations indicate that *P. calcariferus* uses logs and the sheaths of palm fronds as diurnal retreats. Over the course of the study, we observed 14 instances of parental care. Most observations involved young guarded by solitary females. However, there were 3 instances in which young were found in the presence of both an adult male and female. The number (4-40) and relative size (small, medium, large) of the young varied in a relatively, consistent pattern. In general, we observed a negative relationship between the number and the relative body size of the young being guarded. Our observations represent the first report of parental care for harvestmen in the family Cranaidae.

- P75 HARRIS, ERIC S. AND STEPHEN C. LANDERS. Troy University—Survey of protists from lakes and ponds at Troy University.

The Troy University Campus has numerous ponds and lakes with potential research and teaching value. For this reason, an inventory of the protists from Lake Lagoona on campus was initiated last year. This inventory has now been continued for a second year, with two ponds from the University golf course added to the survey. Plankton tows and

glass slide traps were used to collect planktonic and attached protists. Organisms were sketched, measured, and photographed from live samples. Also, permanent preparations were made from the submerged slides. Included in this report are several new genera as well as many that were collected last year. Our survey includes: *Aspidisca*, *Coleps*, *Dileptus*, *Opercularia*, *Paramecium*, *Platycola*, *Urocentrum*, *Vaginicola*, (ciliates); *Euglena acus*, *Euglena oxyuris*, *Euglena spirogyra*, *Peridinium*, *Poteriodendron*, (flagellates); *Acanthocystis*, *Arcella*, *Clathrulina*, (amoebae); *Closterium*, *Cosmarium*, *Dictyosphaerium*, *Sirogonium*, *Sphaerozosma*, *Staurodesmus*, *Ulothrix*, (chlorophytes); *Anabaena*, *Merismopedia*, *Oscillatoria*, *Spirulina*, (blue-green algae); *Achnanthes*, *Amphora*, *Cyclotella*, *Cymbella*, *Gomphonema*, *Hantzschia*, *Navicula*, *Pinnularia*, *Stauroneis*, *Surirella*, *Synedra*, (diatoms). In addition to these organisms, several metazoans were collected and identified, including a gastrotrich, *Chaetonotus*, the cnidarian *Hydra*, and several rotifers - *Collotheca*, *Conochiloides*, *Filinia*, *Kellicottia*, *Philodina*, *Testudinella*, and *Trichocerca*. This inventory will be expanded by further collections in the winter and spring. Support for this project was provided by a Troy University Chancellor's Fellowship awarded to ESH.

- P76 HILL, JOVONN G; RICHARD L. BROWN; AND JOE A. MACGOWN. Mississippi Entomological Museum—Environmental variables affecting ant (Formicidae) community composition in four habitats in Mississippi.

Numerous species of ants have habitat preferences and respond quickly to disturbances to their environment, making them valuable for habitat monitoring. However, the effects of various environmental variables remain uncertain. This study investigates the relationship of ant community composition to various habitat characteristics by comparing ant communities and 12 environmental variables across four habitat types in Mississippi. The four habitat types include pasture, prairie, and oak-hickory forests in the Black Belt and forests in the Flatwoods physiographic region. Ants were sampled using pitfall traps, litter sampling, baiting and hand collecting. NMS and ANCOVA both revealed three distinct ant communities (pasture, prairie, and "forests") between the four habitat types based on species composition and mean ant abundance per habitat type. Principal component analysis (PCA) partitioned the environmental variables into four axes with eigenvalues >1 . Axis 1 divides the site into two types (open and forests), while axis two separates pasture from prairie. Multiple regression models using the four significant PCA axes revealed that total species richness was significantly affected by variation in the first two PCA axes. Forested sites supported approximately nine more species of ants than prairies, and 21 more than pastures ($p=.0001$). Comparisons of ant functional group abundance were also made between the four habitat types with multiple regression models to investigate how the environmental variables affected certain groups of ants.

- P77 HUNTER, REBECCA K.¹, DANIEL N. PROUD¹, JESSICA A. TIBBETTS¹, JESSICA A. BURNS¹, VICTOR R. TOWNSEND, JR¹, AND MICHAEL K. MOORE². Virginia Wesleyan College¹ and Mercer University²—Field observations of the natural history of the harvestmen (Arachnida, Opiliones) of Trinidad, W. I.

Relatively little is known about the ecology or natural history of the 24 species of harvestmen that are known to occur in Trinidad, West Indies. From 9 July to 5 August 2005, we collected harvestmen in the Northern and Central Ranges of Trinidad from a variety of locations including Mount Tamana, Petite Tacarib, Brasso Seco Paria Village, Morne Bleu Ridge, and the summit of Mount Aripo. In these areas, we sampled several microhabitats including tree buttresses, the sheaths of palm fronds, logs, and bromeliads. During daylight hours, adult *Cynortula undulata* and *Prionostemma vitattum* were frequently encountered in the leaf litter and on the surfaces of the vegetation. Other individuals including adult *Stygnoplus clavotibialis*, *Phareicranaus calcariferus*, and *Santinezia serratotibialis* were most often collected in retreats during the day and were more active after dusk. We collected 458 adults representing 16 species. However, we only observed 7 instances of feeding. Prey included termites, beetles, flies (larvae and adults), ants, and floral parts. In addition, we observed 17 instances of aggregation behavior involving adults of *S. clavotibialis* (2 groups; range 21-36), *P. vitattum* (1 massive

group of thousands), and adult and young of *P. calcariferus* (14 groups involving at least 1 adult and 4-40 young).

- P78 LEE, SANGMI and RICHARD L. BROWN. Mississippi State University—A review of Symmocinae (Lepidoptera: Autostichidae) in North America with the description of a new species and new genus.

The moth subfamily Symmocinae (Gelechioidea: Autostichidae) includes 170 species in 42 genera, with greatest diversity in xeric areas of the Palearctic Region. The absence of autapomorphies for defining Autostichidae have led to two differing phylogenies of the superfamily. One native species, *Sceptea aequipulvella*, and two introduced species, *Oegoconia quadripuncta* and *Symmoca signatella* are known to occur in North America. Fifty-one specimens of a new genus and new species have been collected in prairies, cedar glades, old fields, and a variety of dry forests in Alabama, Mississippi, Louisiana, and Kansas. The new genus is defined by apomorphies of the hind tibia, antenna, thoracic endoskeleton, and male genitalia. These apomorphies indicate a relationship with both Autostichidae and Blastobasidae. The imago, wing venation, male and female genitalia and distribution of the new genus and new species are figured.

- P79 MARTINEZ, EDDA AND RICHARD L. BROWN. Mississippi State University—Argyriini (Lepidoptera: Crambidae) of Mississippi and Alabama with redescription of *Argyria rufisignella*.

The tribe Argyriini includes seven species of *Argyria* and *Urola* associated with grasslands and other open habitats in Alabama and Mississippi. *Argyria rufisignella* is a rarely collected species previously recorded from Texas, Florida, and North Carolina. A series of this species recently was collected at Bibb County Glades Preserve, Alabama, a floristically unique habitat that has been termed a “Botanical Lost World.” The imago, wing venation, and genitalia of *A. rufisignella* are illustrated for the first time, and diagnoses, distribution maps, and photographs are provided for other Argyriini that occur in Alabama and Mississippi.

- P80 MATTOS, CAITLIN¹, REBECA ROSENGAUS² AND JOHN W. STILLER¹. East Carolina University¹ and Northeastern University²—Determining the influence of bacterial and fungal loads on the sociality of the termite *Nasutitermes corniger*.

The termite species *Nasutitermes corniger* is interesting because of its unique family structure within nests. While all groups of these termites have queens and kings that function as the source of reproduction within the family, the quantities and relationships of queens and kings vary greatly from colony to colony. It was hypothesized that the fungal and bacterial loads somehow influence these varied relationships among colonies. Cuticle washes of individual workers, as well as trail and nest materials, have been obtained from several different colonies. The molecular genetic components of these samples are determined using both 16s (for bacteria) and 18s (for protists and fungi) ribosomal gene universal PCR primers. The PCR products recovered are then restriction digested and unique banding patterns observed by electrophoresis. Bands with different restriction patterns are sequenced to identify the eukaryotic and prokaryotic organisms present within the colonies; overall number and intensity of fragments recovered in PCR reactions provide a rough estimate of the relative quantities of individual organisms present. These molecular genetic estimates will be compared with those from culturing studies, and correlated with patterns of social behavior.

- P81 PROUD, DANIEL N.¹, VICTOR R. TOWNSEND, JR¹, MICHAEL K. MOORE², AND PAUL M. RESSLAR¹. Virginia Wesleyan College¹ and Mercer University²—A potential new species of harvestmen (Opiliones, Manaosbiidae) from Morne Bleu Ridge in the Northern Range of Trinidad, W. I.

Prior taxonomic studies of the harvestmen of Trinidad, W.I. have documented the occurrence of 24 species on the island, including 2 species (*Cranelius montgomeryi* and *Rhopalocranaus albilineatus*) of the family Manaosbiidae. Relatively little is known about the distribution or natural history of these harvestmen. For *C. montgomeryi*, only the

female has been described. From 9 July to 18 July 2005, we collected representative specimens of 15 known species of harvestmen from sites within the Northern and Central Ranges. During this period of time, we collected female *C. montgomeryi* and adult male and female *R. alblineatus* from several locations. From 20 July to 5 August 2005, we hiked and camped along Morne Bleu Ridge and visited the summit of Mount Aripo. At these sites, we collected adult males and females of a Manaosbiid species that we had not previously observed on the island. The species was only collected in montane rainforest and elfin woodland (elevations above 600 m). Individuals were commonly encountered in the leaf litter, but were also found beneath logs and in or beneath the sheaths of palm fronds. Activity was observed during the day and night. Presently, we are employing scanning electron microscopy to examine important diagnostic characters, including genitalia and the armature of the pedipalps and legs.

- P82 SELLERS, ANGELA B., MERIDITH E. FINN, CHRISTOPHER M. SCOCCO, ASHLEY E. PINKLETON, AND C. BRIAN ODOM. Wingate University—Prevalence of RAPD markers within colonies representing the two social forms of the Red Imported Fire Ant, *Solenopsis invicta*, (Buren), in Union County, North Carolina.

The Red Imported Fire Ant, *Solenopsis invicta* (Buren), exists in two distinct social forms, polygyny and monogyny. Monogynous colonies possess a single, fertile queen, while polygynous mounds contain multiple fertile queens. A single genetic locus has been identified and shown to be responsible for these two social forms. Diagnostic polymerase chain reaction (PCR) specific for the social allele was used to select colonies from Union County, NC, representing each social form. Multiple, individual, non-alate specimens from these mounds were subjected to RAPD (Random Amplified Polymorphic DNA Analysis) PCR. The diversity of RAPD markers among individuals from polygynous and monogynous colonies was compared.

- P83 SUDBRINK JR., DONALD L. AND STEVEN HUGHES, Delta State University—Spatio-temporal aspects of mortality factors impacting gall-forming insect populations on goldenrod in the Yazoo-Mississippi Delta.

Goldenrod species (*Solidago* spp.) often form the dominant vegetation in old-field communities in eastern North America, and are the basis of multi-trophic communities which include gall-forming herbivores and associated predators. In 2005, an investigation of these communities was initiated at Dahomey National Wildlife Refuge (NWR) in the Yazoo-Mississippi Delta. In this study, the ball gall fly, *Eurosta solidaginis*, (Diptera: Tephritidae), was the most commonly encountered gall forming insect species on goldenrod. Larvae of this species were preyed upon by several insect and vertebrate species including two wasps, *Eurytoma obtusa* and *E. gigantea*. (Hymenoptera: Eurytomidae), a beetle larva, *Mordellistena convicta* (Coleoptera: Mordellidae), downy woodpecker (*Picoides pubescens*), and Carolina chickadee (*Poecile carolinensis*). Spatial distribution of the galls was sampled in a series of transects in old-fields and wooded sites at Dahomey NWR. Sampling occurred in autumn, prior to hard freeze, and in late winter to monitor populations before and after bird predation. Transects were sampled from woods edge outward into old-fields at 50m intervals for approximately 300m. Survival of *E. solidaginis* was reduced due to early larval death and insect predation in autumn. In late winter, Downy woodpecker predation was the highest predator-induced mortality factor. Woodpecker predation was most frequent near woods-edge and declined markedly outwards into exposed old-field sample sites. Insect predation on *E. solidaginis* varied throughout most old field sample sites, but was reduced at woods edge and in wooded sites.

- P84 TIBBETTS, JESSICA A., DANIEL N. PROUD, AND VICTOR R. TOWNSEND, JR. Virginia Wesleyan College—Use of logs by arthropods in the rainforests of the Northern Range of Trinidad, W. I.

There is a general lack of information concerning the microhabitat preferences of neotropical, terrestrial arthropods, particularly arachnids. In this study, we investigated the

use of logs by arthropods in the rainforest adjacent to the beaches of Petite Tacarib in Trinidad during the wet season. From July 12-15, 2005, we sampled small (mean diameter = 13.1 cm; n = 15) and large logs (mean diameter = 32.6 cm; n = 16) in a variety of states of decay. During sampling, logs were visually scanned, rolled and broken apart. All arthropods found in or under the log were immediately preserved in 10% formalin for later identification. We collected a diverse assortment of arthropods, including 7 species of harvestmen and 1 species of amblypygid. We also found several species of spiders, centipedes, and millipedes as well as a variety of ants, termites, beetles, and cockroaches. The overall mean density of harvestmen per log varied between logs of different sizes. Large logs had a mean of 3.6 harvestmen, whereas small logs had a mean of 2.5 individuals. The most abundant species was *Cynortula undulata* (1.3 individuals/log) and the least common species was *Ethobunus tuberculatus* (we only caught 1 individual). For amblypygids, we captured 18 individuals of *Phrynus pulchripes*, with a mean of 0.7 individuals for large and 0.5 for small logs.

P85 TOWNSEND, VICTOR R. JR¹, AND MICHAEL K. MOORE². Virginia Wesleyan College¹ and Mercer University²—The harvestmen (Arachnida, Opiliones) of Trinidad, W.I., with comments on new locality records.

Prior studies of the harvestmen of Trinidad, West Indies have revealed the occurrence of 24 species on the island. Species recorded for Trinidad include representatives from 8 families: Agoristenidae (3 species), Cosmetidae (8 species), Cranaidae (2 species), Manaosbiidae (2 species), Samoidae (2 species), Sclerosomatidae (5 species), Stygnidae (1 species), and Zalmoxidae (1 species). Relatively little is known about the ecology, natural history, or distribution of these species. Prior collections of harvestmen in Trinidad have occurred mostly in Tucker Valley (southwestern corner), Port of Spain, and Mount Tucuche. From 9 July to 5 August 2005, we collected harvestmen from rainforests in several locations including the Brasso Seco Paria Village, Morne Bleu Ridge, Petite Tacarib, and Mount Tamana. We collected 16 species, including 1 previously unreported species of Manaosbiid. Our field collections of harvestmen indicate that most species are widely distributed and occur in more than one type of rainforest. *Cynortula undulata* (Cosmetidae) was the most commonly encountered species. In contrast, we collected relatively few individuals (five or less) of six species, *Ethobunus tuberculatus* (Zalmoxidae), *Maracaynatum trinidadense* (Samoidae), *Pellobunus longipalpus* (Samoidae), *Trinella albionorta* (Agoristenidae), *T. intermedia* (Agoristenidae), and *T. leiobuniformes* (Agoristenidae).

P86 WOOLFOLK¹, SANDRA, RICHARD BAIRD¹, AND CLARENCE WATSON². Department of Entomology and Plant Pathology, P.O. Box 9655¹, MAFES Administration, P.O. Box 9740², Mississippi State University, Mississippi State, MS 39762—Microflora associated with black imported/hybrid fire ants and their mounds in Mississippi.

A study was conducted to determine biodiversity indices of bacterial and fungal microflora associated with black imported/ hybrid fire ants in Mississippi. Lower third portion of active mounds were collected from the following four environments: Oktibbeha County in October 2002 (environment 1), Clay County in November 2002 (environment 2), Lowndes County in December 2002 (environment 3), and Noxubee County in January 2003 (environment 4). Species richness, species diversity and coefficient of community of bacterial and fungal microflora isolated from fire ants, soil mounds, and plant debris within the mound were measured. Total species richness of bacteria and fungi were 27 and 58, respectively. The most common bacterial and fungal taxa recovered were *Chryseobacterium indologenes* and *Pythium*, respectively. Species richness of bacteria and fungi in soil mound community were higher (53 and 22, respectively) compared to those of ant (16 and 17, respectively) and plant debris (8 and 21, respectively) community. Total species diversity of bacteria and fungi were 0.60 and 0.72, respectively. Species diversity of bacteria and fungi from soil mounds were greater (0.89 and 0.74, respectively) compared to those of ant (0.71 and 0.66) and plant debris (0.53 and 0.67, respectively) community. Coefficient of community (CC) was evaluated by comparing number of taxa

common to ant-plant debris, ant-soil mound and soil mound- plant debris communities. The CC values for bacteria were 0.74, 0.77, and 0.79, respectively. The CC values for fungi were lower compared to those of bacteria (0.33, 0.35, and 0.23, respectively).

- P87 DEES, WILLIAM H.¹, GEORGE W. SCHULTZ², RICHARD G. ROBBINS² AND DAVID W. HILL². McNeese State University¹ and Armed Forces Pest Management Board²-Ixodid tick morphology and identification: A laboratory teaching tool.

A computer-based teaching program on ixodid tick morphology and identification has been developed to complement laboratory education and training in medical entomology, pest management and public health. This program aids in the identification of ticks to the species level in the following genera: *Amblyomma*, *Aponomma*, *Boophilus*, *Dermacentor*, *Haemaphysalis*, *Hyalomma*, *Ixodes* and *Rhipicephalus*. The program contains 29 pictorial and non-pictorial identification keys to ixodid ticks from seven geographical regions worldwide in PDF format. There are five major sections in the program: (1) tutorial in tick morphology, (2) demonstration in identifying ticks by an expert, (3) student identification practice, (4) glossary of tick morphology, and (5) ixodid identification keys. The tick morphology section covers important identifying characteristics of the tick capitulum, legs and idiosoma. The glossary contains 62 terms used in tick taxonomy. A soundcard and Adobe Acrobat™ are required to operate this program.

Microbiology

- P88 CHRISTOPHER, LYLES, QUENTON FONTENOT, AND RAJ BOOPATHY. Nicholls State University-Use of Sequencing Batch Reactor to Control Nitrogen and Carbon Concentrations in Shrimp Aquaculture Effluent.

The Sequencing Batch Reactor (SBR) is a variation of the activated sludge biological treatment process. This process uses multiple steps in the same tank to take the place of multiple tanks in a conventional treatment system. The SBR accomplishes equalization, aeration, and clarification in a timed sequence, in a single reactor basin. This is achieved in a simple tank, through sequencing stages, which includes fill, react, settle, decant, and idle. The sludge from a backwash of a single bead filter from the Waddell Mariculture Center, SC was successfully treated using a SBR. The sludge contained high concentrations of carbon and nitrogen. By operating the reactor sequentially, viz, aerobic, anaerobic, and aerobic modes, nitrification and denitrification were achieved as well as removal of carbon. The SBR system showed promising results and should be further tested for various shrimp wastewaters from different sources such as raceway, ponds, and sludges from multiple sites, which operate under different temperature and salinity conditions.

- P89 DIEHL, SUSAN¹, LYNN PREWITT¹, AND TOM MCELROY². Mississippi State University¹ and Kennesaw State University²-Phylogeny of select wood decay fungi.

Our long term goal is to develop methods for rapid and accurate analysis of the complex microbial populations involved in wood decay and biocide breakdown. We are using ITS-RFLP and ITS sequence data for identification of species, t-RFLP for community analysis and ultimately, AFLP for distinguishing isolates within a species. Amplification of the ITS region is by the ITS1-forward and ITS4-NS reverse (for general fungi) or ITS4-B reverse (Basidiomycetes). Four enzymes (*AluI*, *TaqI*, *HaeIII*, and *HinfI*) have been run for ITS-RFLP. RFLP and sequence data for up to six isolates of seven basidiomycete species are being compared using a simple matching similarity matrix for each restriction enzyme and analyzed with hierarchical cluster analysis in SYSTAT and Phylip. When up to seven isolates of six species of basidiomycota were compared by RFLP, a given species could be distinguished at the 95% confidence level with a similarity of 0.93 or greater. Although isolates of a given species mostly clustered together and species were distinguishable, there were some noticeable separations among isolates within a given species. Changing

the binning parameters did NOT improve the accuracy of identifications. We will also discuss a comparison of the RFLP data and sequence data (which is currently being analyzed) and the occurrence of isolate outliers.

- P90 LETHA, DAWSON AND RAJ BOOPATHY. Nicholls State University—Use of Agricultural Wastes in Ethanol Fermentation.

Agricultural residues are produced in plentiful. Approximately, one Kg of residue is produced for each kilogram of grains harvested. This ratio of grain/residue translates into an excess of 40 billion ton of crop residue produced each year in the USA. These residues are renewable resources that could be used to produce ethanol and many other value added products. In this study, we demonstrate that the post-harvest sugar cane residue could be used to produce fuel grade ethanol. A chemical pre-treatment process using alkaline peroxide was applied to remove lignin, which acts as physical barrier to cellulolytic enzymes. Two yeast strains including *Saccharomyces cerevisiae* ATCC strains 765 and 918 were used in the experiment. The pre-treatment process effectively removed lignin. Alcohol production in the culture sample was monitored using gas chromatography. The results indicate that ethanol can be made from the sugarcane residue. The fermentation system needs to be optimized further to scale up the process for large-scale production of ethanol from sugar cane residue.

- P91 MUNDELL, AMY, HEATHER SUTTON AND THOMAS MCELROY. Kennesaw State University—Soil fungal diversity among *Cypripedium acaule* communities.

The pink lady slipper orchid, *Cypripedium acaule*, is a large, showy wildflower that is a native terrestrial orchid listed as unusual, endangered or exploitably vulnerable and endangered throughout the northeastern and southeastern United States. The pink lady slipper is listed in Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) and is also protected through various individual states and federal programs .The orchids' habitat is very selective and little is known about the microbial community or soil requirements for growth and maintenance of the orchid. Soil samples were collected from a large community of pink lady slipper orchids after emergence from their dormant period. Understanding soil community structure will play an important role in preservation and/or relocation of pink lady slipper orchids that are in danger of certain demise. Terminal restriction fragment length polymorphism (TRFLP) is a culture independent method used to analyze the microbial communities. Whole genomic DNA was extracted from the soil samples. The ITS region of the fungal genome was subjected to PCR amplification with fluorescently labeled primers. The amplicons were cut with *TaqI* endonuclease restriction enzyme and the fragments were analyzed with an ABI 310 Genetic Analyzer. Differences in microbial communities within and among *C. acaule* populations are being analyzed and will be discussed.

Ornithology

- P92 HARRIS, J. B. C., D. G. HASSELL, AND K. WILLIS. Sewanee: The University of the South—Quantitative analysis of Breeding Bird Survey biases: Implications for conservation planning in North America.

We have used Geographical Information Systems (GIS) to quantify roadside sampling bias of the North American Breeding Bird Survey (BBS) in Tennessee. This bias was detected by comparing land cover proportions near roads to that of the entire landscape. If certain land cover types tend to be located near roads, then roadside surveys could sample habitats in different proportions from that of the entire landscape. We used GIS to compute land cover proportions in 50 m, 200 m, and 400 m buffers around a road layer and compared to the entire landscape of the area. This was done with fine resolution vector land cover data (over five years) and with coarse raster National Land Cover Dataset (NLCD) data in a seven county area on the southern Cumberland Plateau. Tennessee's 51 breeding bird survey routes were also buffered and clipped to NLCD data. Buffers had significantly different land cover proportions than the landscape as a whole.

The differences were most pronounced in the NLCD data and with residential land cover. Lastly, we used bird densities (collected previously) in the different Cumberland Plateau land cover types and the land cover proportions calculated in the present study, to yield theoretical population trends for 82 bird species. Bird population trends based on buffer land cover proportions differed dramatically from trends based on proportions of the entire landscape for many of the bird species. This study shows that the BBS does not sample land cover types in the same proportions as those found on the entire landscape in Tennessee. Thus, the BBS may give a biased view of breeding bird populations in North America.

- P93 OLSZAK, JASON D. AND KIM MARIE TOLSON. University of Louisiana Monroe—Silvicultural effects on the breeding avifauna of a bottomland hardwood wildlife management area in northeast Louisiana.

Over time the bottomland hardwood forests that made up the bulk of the Lower Mississippi Aluvial Plain (MAP) have been reduced by 80%. This forest type contains some of the most imperiled Stewardship and Watch List bird species according to the Partners in Flight- North American Landbird Conservation Plan. Conservation of avian species, with an emphasis on neotropical migrants, within the land that remains has therefore become the focus of numerous state and federal management programs. The 2,832 ha Bayou Macon Wildlife Management Area (BMWMA) in East Carroll Parish, Louisiana has been identified as such a tract of bottomland hardwood habitat. The management of BMWMA has included silvicultural treatments meant to diversify the canopy structure. 607 ha of the area was replanted in typical hardwood species after acquisition in 1991. Fifteen line transects (500m with point counts at 0m, 250m, and 500m) were selected for breeding season (mid-April through June) surveys, and each was visited five times during the spring. Transects were represented by silvicultural treatment in an attempt to reveal possible effects of treatment on bird communities. Two types of management cuts were implemented; shelterwood and individual selection. Untreated “natural” areas were also sampled. Resulting Simpson’s diversity indices of the forested components were .864, .866, and .851 respectively. Recently reforested areas were also considered where a lower diversity index of .770 resulted. Total point counts (N=225) revealed a breeding bird species richness of R=59. Overall, 68 species were encountered in spring point counts.

- P94 QUINN, JOHN AND KIM MARIE TOLSON. University of Louisiana at Monroe—Avian populations of multiple forest treatment types within the Mississippi Alluvial Valley: A breeding bird survey of Boeuf Wildlife Management Area.

State Wildlife Grants were created to facilitate the development of a Comprehensive Wildlife Conservation Strategy within each state. These strategies seek to incorporate non-game species and species of conservation concern into traditional management plans originally directed towards game species. With 75% of the original forest cover in bottomland hardwoods lost, breeding birds of the Mississippi Alluvial Valley (MAV) warrant our conservation efforts. To understand how silviculture management techniques in bottomland hardwood forests impact avian populations, the Louisiana Department of Wildlife and Fisheries commissioned breeding bird surveys on selected state owned wildlife management areas (WMA). For this study breeding bird surveys were conducted from April 2005 through the first week of July 2005 at Boeuf Wildlife Management Area, located in Caldwell and Catahoula parishes of northeast Louisiana. A total of 189 point counts were conducted on 22 transects in treated and untreated forests as well as young hardwood plantations. Relative abundance, species richness and diversity were compared across silviculture treatments. A list of confirmed breeding birds (N=21) on the WMA has been generated as well as a checklist of all avian species encountered (N=173) to include those detected outside the constraints of the survey for use by citizen birders and the general public. A second field season will begin in April 2006. This study is supported by funds provided by LDWF & USFWS, Division of Federal Aid through State Wildlife Grants Program.

- P95 SIMS, CHRISTOPHER G. AND IAN NALL. THE UNIVERSITY OF ARKANSAS AT MONTICELLO—Sibling competition and parental provisioning in nestling Carolina chickadees (*Poecile carolinensis*).

Carolina chickadee (*Poecile carolinensis*) nests were observed to determine if sibling competition influences parental provisioning and/or nestling growth rate. We predict that a hierarchy exists among nestlings with some individuals gaining priority positions in the nest or out begging other siblings for parental provisioning. Dominant siblings should experience a higher growth rate and possibly increased success post fledging. Nest boxes were constructed and placed in a managed hardwood/pine forest on the campus of the University of Arkansas at Monticello. Nest boxes were monitored frequently to determine the date of nest building, egg laying, and hatch date. Beginning 3 days post hatch, and continuing every other day until fledging, nestlings were removed from the nests and measured to determine mass and tarsus length. Each nestling received a unique colored paint mark on its head and one toenail was clipped for future identification. On day 4 post hatch, and continuing every other day until fledging, each nest was video taped for a one hour session in order to observe nestling and parental provisioning activity. The following points were observed and recorded from the video sessions: 1) nestling position relative to the entrance 2) begging rate 3) nestling being fed per visit. Begging was ranked in one of three categories: S1 = no begging, S2 = begging while sitting, S3 = begging while standing. Nest data is currently being analyzed. This study will provide insight into the early life-history of Carolina chickadees and preliminary data for research on natal dispersal in this species.

Parasitology

- P96 O'BRIEN, MIKE AND JESSICA SHAW, Murray State University. Murray KY—Blood and fecal parasites of the tiger salamander (*Ambystoma tigrinum nebulosum*) according to life stage.

This study provides a unique look at differences in parasite prevalence within two life stages of tiger salamanders, *Ambystoma tigrinum nebulosum*. Individuals in the paedomorphic life stage reach maturity while retaining larval characteristics such as gills and a membranous tail. It is also these characteristics which bind them to an aquatic lifestyle. Metamorphic individuals commonly transform before becoming adults and lose their larval characteristics, allowing them to enter the terrestrial environment. These life stages separate the individuals into two ecosystems (aquatic and terrestrial) which suggest that differences between parasites in the same host species might occur according to life phase. Juveniles were also sampled for parasites, providing a third life stage for comparison. Within juvenile stages a cannibalistic morph, characterized by a wider mouth and enlarged "teeth", also occurs. We hypothesized that metamorphic adults should have higher prevalence of blood parasites (e.g., trypanosomes) due to increased exposure to vectors and that cannibals should have a higher prevalence of intestinal parasites because of increased exposure after eating infected larvae. Blood and fecal samples of tiger salamanders were collected from ponds in south-central Colorado in 2004-05. Blood smears ($N = 128$) were prepared in the field while parasite eggs ($N > 100$) were separated from fecal samples with a sucrose gradient floatation and prepared for observation under a microscope. Results of both analyses will be presented. Support for this research was received from a grant of the National Science Foundation.

- P97 BARTER, KATHERINE, BS, MT¹ AND JAMES R. PALMIERI, Ph.D². Virginia Polytechnic Institute Department of Biochemistry¹ and Center for Molecular Medicine and Infectious Diseases Virginia Maryland Regional College of Veterinary Medicine¹ and Department of Microbiology Division of Biomedical Sciences Virginia College of Osteopathic Medicine². Gentamicin and the Symbiotic Relationship Between *Francisella* and *Acanthamoeba*: The Threat of an Epidemiological Crisis.

Acanthamoeba are protozoa that inhabit a variety of environments. Most species of Acanthamoeba are nonpathogenic, however, several species are pathogenic and known to cause granulomatous amoebic encephalitis or amoebic keratitis in humans. Acanthamoeba exist in both the feeding trophozoite and dormant cyst stages. The cyst stage is highly resistant to physical, chemical and radiological conditions. Previous research indicates many bacteria species survive within both stages of Acanthamoeba. This symbiosis may have contributed to the ability of bacteria to survive and adapt their existence within macrophages. Previous research indicates many pathogenic bacteria utilize the same genes to grow in macrophages as inside Acanthamoeba. It is hypothesized that interactions and adaptations undergone by microorganisms living in Acanthamoeba may have contributed to the evolution of intracellular bacteria. In 2003, Abd et al reported that *Acanthamoeba castellanii* growth dropped 25% when co-cultured with *F. tularensis* compared to when grown alone. In their study, 250µg/mL of Gentamicin was added to a centrifuged *Acanthamoeba-Francisella* pellet to minimize extracellular *F. tularensis* contamination. The resultant decrease in Acanthamoeba population was attributed to unidentified toxic affects of *F. tularensis*. Our laboratory recognized the significance of *Francisella* colonization of Acanthamoeba, but attributed the decrease in amoeba growth to the addition of Gentamicin, not the presence of *Francisella*. We investigated the effects of increasing concentrations of gentamicin on the growth of three species of Acanthamoeba: We found that Acanthamoeba grown in increasing concentrations of Gentamicin resulted in a drop in population of the three tested species of Acanthamoeba.

P98 SCHAUMBURG, COLLIN AND PAUL SIKKEL Murray State University—Do parasite loads vary with host and environmental parameters in bluegill sunfish (*Lepomis macrochirus*)?

Parasites have been found to affect the health, behavior, and life history of fishes (Bartoli et al 2000), including reproduction (e.g., mate choice and parental investment), and habitat choice. Centrarchid sunfishes (*Lepomis*) are among the best-studied North American fishes. Considerable data exist on their reproductive habits, diet, and habitat choice. While descriptive studies have characterized parasite communities of sunfishes elsewhere, little is known about parasite communities on fishes in western Kentucky, or the relationship between parasites and the behavior and ecology of sunfishes generally. As a first step in addressing this lack of knowledge, I conducted a field study on parasite loads associated with the gill lamellae of bluegill sunfish (*Lepomis macrochirus*), I hypothesized that: 1) males will have a higher rate of parasitism than females due to decreased mobility associated with defending the nest; 2) parasite loads will be higher in vegetated habitats; 3) gill parasites will be most abundant on the first; and 4) parasite loads will change throughout the spawning season. I collected fish by rod and reel and cast netting at different sites in Western Kentucky. Fish were sexed and processed in the laboratory to determine loads of parasitic monogeneans. Sampling of fish was conducted throughout the spring and summer spawning season (water temperature >65oF). Parasites were found to be significantly more abundant on the second gill arch, and parasite abundance differed significantly over time. Although parasite loads tended to be higher for males, the difference was not significant.

Plant Biology

P99 HYATT, PHILIP. United States Department of Agriculture, Forest Service, Southern Region—*Megaceros aenigmaticus*, a southern Appalachian endemic hornwort, new to Georgia.

Megaceros aenigmaticus, is reported from a single location in north central Georgia in Fannin County. This southern Appalachian endemic was previously known from the southern portions of eastern Tennessee and western North Carolina. This hornwort occurs near the trailhead of the Appalachian Trail's southern terminus at Springer Mountain. Surveys during 2003 and 2004 revealed one or more colonies in the vicinity of all three streams meeting near the Trail at Three Forks. Plants only occur in splash zones or within

perennial rocky streams at elevations above about 700 meters within its limited range. Additional sites should be sought in similar habitats in northern Georgia and adjoining nearby states.

- P100 LOKUGE, MEEPA, DAVID FRANCKO AND KENNETH WILSON. Miami University—A proteomic approach to investigate cold tolerance mechanism in *Rhapidophyllum hystrix* (Needle Palm).

Needle palm, the most cold-hardy palm investigated to date, is native to the southeastern US. It has reportedly survived temperatures as low as -23 C without significant damage to foliage. Plants have evolved efficient strategies to tolerate extreme winter conditions i.e. super cooling and cold acclimation. Adaptations of freezing tolerance in plants are associated with numerous physiological and genetic alterations that are necessary to protect vital physiological processes and critical cell structures. They are regulated by a complex system that is programmed at the gene expression level. These gene products may be involved in freezing tolerance. We hypothesized that identifiable, cold-inducible proteins can be isolated and characterized in cold-hardy palms, using leaf protein profiles as starting material, and that these protein markers will not be present in tissues from non-cold acclimated cold-hardy species. To elucidate the underlying molecular mechanism in needle palm cold tolerance, we initially focused on the quantitative changes in the leaf proteome. We compared the protein profiles of cold-treated and untreated plants using Biorad PDQuest software. Variations in protein spots were evaluated by appearance, disappearance, spot number and intensity. Spots of interests were excised from preparative 2 D gels and analyzed by MALDI TOF MS. Proteins were identified by database searching against NCBI and SWISS-PROT. To date we have successfully identified 14 proteins out of 62 that have shown to be upregulated during cold treatment of needle palm. We will report the complete proteomic analysis of the cold tolerance in needle palm along with supercooling point measurements.

- P101 OSMAN, MUNA, KENNETH WILSON, DAVID FRANCKO, CATHLENE LEARY-ELDERKIN, CASI THOMPSON, AND ANNE SIMILELE—In vitro propagation of palms using protocols for bananas.

The successful *in vitro* propagation of cold-hardy bananas (*Musa* sp.) in our laboratory uses a method efficacious in over 180 different varieties of bananas, encouraging us to explore the utility of this media system in palms. Specifically, in order to develop new propagation techniques for the commercially-important cold-hardy species *Sabal minor* and *Sabal palmetto*, as well as other more valuable palm species, banana multiplication media was used to enhance the rate of formation of palm shoots. One- to three-year-old plants of *S. minor* and *S. palmetto* were dissected and apical meristem explants were cultured in banana multiplication media for one month. In bananas, cytokinin suppresses the apical meristem, effectively stimulating the formation of lateral meristems from the original dissected sample. Also in bananas there appear to be age-related factors which may increase the natural production of lateral meristems. Our data suggest that a similar age-related phenomenon may occur in palms, because 2- and 3-year-old plants responded differently to multiplication media than did 1-year-old plants. Normally the palms under study do not develop lateral meristems, but under experimental conditions they show a significant increase in lateral meristem development in response to banana multiplication techniques.

- P102 POINDEXTER, DERICK B, VICTORIA FERRISS, GARRETT KELLY, AND HOWARD S. NEUFELD. Appalachian State University—The relationship between light and anthocyanin production in above and belowground tissues of *Galax urceolata* (Poir.) Brummitt.

Galax urceolata (Poir.) Brummitt (Diapensiaceae) is a common evergreen herb of southern Appalachian forests. During the fall and winter months, leaves of plants in high light environments produce substantial amounts of anthocyanins and turn a burgundy red color. Recent work in our lab has shown that these anthocyanins attenuate excess green light, thereby preventing photoinhibition of the spongy mesophyll cells. However, we have

also noticed that subterranean organs (i.e. rhizomes) also contain anthocyanins. If anthocyanins serve a photoprotective role, then what is their function, if anything, in belowground tissues? The purpose of this study was to identify seasonal trends in anthocyanin production in both the above and belowground tissues of *G. urceolata*. Our hypothesis was that plants in high light would have higher anthocyanin amounts in both above and belowground tissues compared to plants in low light. Plants from Mount Jefferson State Natural Area in NC were sampled on three dates in 2005 (Oct 12, 27 and Nov 13). Over this period, we found significant increases in anthocyanins for leaves and rhizomes of high light plants compared to shade plants, but not in the petioles. Anthocyanins in rhizomes were distributed throughout the entire cross-section except for the vascular tissues. In petioles, they were restricted to the cell layer just below the epidermis. In addition, anthocyanins were concentrated about lateral roots as they penetrated the cortex. It is suggested that anthocyanins in belowground organs of *G. urceolata* may play a role in detoxifying reactive oxygen species by functioning as potent antioxidants.

P103 SIMIELE, ANNE, CASI THOMPSON, KENNETH WILSON, DAVID FRANCKO, AND MUNA OSMAN. Miami University—Tissue culture techniques for micropropagation of cold-hardy bananas (*Musa basjoo*; Japanese fiber banana).

Bananas are important landscape plants in subtropical environments and are becoming more popular in temperate gardens as cold-hardy species become more available in commerce. One of the best temperate bananas for U.S. landscapes is *Musa basjoo* (Japanese fiber banana), a species that is root-hardy to at least -20F with mulching. Generally, bananas are propagated asexually, by harvesting rooted side shoots or "pups" and planting them directly in soil. Our laboratory has been investigating the efficacy of various tissue culture propagation protocols. We are using two sources of explant material from what we believe may be an economically-important sport of *M. basjoo* that is growing on the Oxford campus; 1) shoot apices from pups and 2) excised flower parts, taking advantage of the unusual 1st-year flowering capability of this sport. Shoot apices cultured on BM2 media produce callus that generates new shoots. To culture floral parts, we removed the intact inflorescence from the plant in late September 2005, surface sterilized it with 75% ethanol, dissected one layer of flower cluster at a time, and place individual florets on culture media. Florets were placed on either MM1 or BM2 media and then cultured in the dark or light at 30° C. Over following months the florets were transferred to newer MM1 or BM2 media and monitored for callus formation and shoot initiation. In sum, both of these techniques show promise for *in vitro* propagation of this putative new banana variety.

P104 STINNETT, AMANDA AND DARLENE PANVINI. Belmont University—Allelopathy in the exotic bush honeysuckle, *Lonicera maackii*.

The exotic bush honeysuckle, *Lonicera maackii*, was introduced into the United States from Asia as an ornamental shrub and has invaded natural and urban areas over much of the eastern United States. Several ecological and biological characteristics contribute to *L. maackii*'s competitive success, including earlier seasonal leaf production and seed germination. Another possibility for its successful invasiveness is that the shrub might produce chemicals that ward off germinating native species thereby preventing their growth. Two experiments were performed to detect the presence of allelopathy in the exotic *L. maackii* shrub. The first study used processed leaves and roots of *L. maackii* mixed with different concentrations of water. Ryegrass and lettuce seeds were grown in the different concentrations of each processed medium. In the second experiment, soil was collected at varying distances from *L. maackii* in the field. Ryegrass and lettuce seeds were sown in the soil samples and germination rates determined. Results indicated that in higher concentrations of leaf and root extracts, ryegrass and lettuce seeds did not germinate as frequently as those grown in lower concentrations of honeysuckle leaf or root extract. Similarly, ryegrass and lettuce seeds had depressed germination when grown in soil collected nearest to bush honeysuckle. These experiments suggest that allelopathy may be a mechanism that *L. maackii* uses to compete with native species. Future studies

are needed to detect the presence of any chemicals that may be produced in the roots and leaves that inhibit seed germination.

- P105 STRAND, DESERAH, DAVID CLEMENTS, DALE VOGELIEN, AND MARINA KOETHER. Kennesaw State University—Selection and preliminary ion analysis of *Ceratopteris richardii* mutants tolerant to toxic levels of cadmium.

Heavy metal toxicity and homeostasis are complex in plants, each associated with a variety of biochemical and physiological processes. This study used the model plant *Ceratopteris richardii* to select for mutants tolerant to toxic levels of cadmium (Cd) and initiate comparative studies with the wild type (W.T.) strain to examine how contributing mechanisms interact to produce an effective strategy for metal tolerance. Using a haploid selection system, two putative mutants were obtained, *Cdt1* and *Cdt2*. Spores collected from completely homozygous *Cdt1* M1 sporophytes showed significantly higher germination rates than sensitive W.T. spores, however mutant and W.T. gametophytes were equally sensitive to increasing levels of Cd. These results indicate that *Cdt1* mutation confers tolerance to Cd only during spore germination. The levels of seven essential minerals and Cd were determined using atomic absorption spectroscopy for *Cdt1* and W.T. spores and gametophytes exposed to no, sublethal and lethal levels of Cd stress. Levels of essential minerals were similar in *Cdt1* and W.T. gametophyte tissue in the absence and presence of Cd stress. Cd and Fe concentrations increased similarly in gametophyte tissue of both strains as external concentrations of Cd increase, suggesting toxicity in W.T. gametophytes is associated with increased Cd and/or Fe accumulation and not alterations in accumulation of other essential cations. Total ion content is similar in W.T. and *Cdt1* spores. Significant differences in the levels of Cu, Ca and Mn were detected between genotypes and may be responsible for the tolerance observed at this stage of development in *Cdt1*.

- P106 THOMAS, BETHANY AND DARLENE PANVINI. Belmont University—Stomatal characteristics in the exotic shrub *Lonicera maackii* compared to the native shrub *Symphoricarpos orbiculatus* in different environmental conditions.

Stomatal characteristics can affect the photosynthetic rates of plants since the number and size of stomata impact gas exchange across the leaf-air interface. Differences in stomatal characteristics have been noted among plants growing in different habitats. This study compares stomatal density, stomatal index, and stomatal length and width between the exotic shrub *Lonicera maackii* and the native shrub *Symphoricarpos orbiculatus*, both in the family Caprifoliaceae. Microscopic analyses of stomatal peels were used to determine abaxial stomatal characters. Samples were analyzed from plants found in three different environmental conditions: low light, intermediate light, and high light. The results suggest environmental condition is the major factor related to differences in stomatal characters, though significant differences were observed between honeysuckle and coralberry. The implications of stomatal characters for rates of photosynthesis and the invasiveness of exotic plants as compared to native species are noted.

- P107 WICKS, KRISTAL AND DARLENE PANVINI. Belmont University—Seasonal rates of photosynthesis and levels of rubisco in exotic and native shrubs and vines of Middle Tennessee.

Exotic plants have direct and indirect effects on native environments, competing with native plant species and altering habitats required by wildlife. While there are known ecological and anatomical differences between exotic and native plant species, less is known about possible physiological differences, specifically those related to the process of photosynthesis. Perhaps faster photosynthetic rates and/or higher levels of photosynthetic enzymes in exotic species allow for quicker growth, resulting in plants that are stronger competitors. Photosynthetic rates and levels of rubisco in exotic bush honeysuckle (*Lonicera maackii*) and exotic *Euonymus fortunei* were compared to native coralberry (*Symphoricarpos orbiculatus*) and native Virginia creeper (*Parthenocissus quinquefolia*). Contrary to our hypothesis that exotic plants would exhibit higher rates of photosynthesis and higher levels of rubisco, our findings showed that there was little difference between

rates of photosynthesis in exotic and native plant species in early autumn, but that natives did have lower photosynthetic rates in late autumn. This would suggest that longer photosynthetic periods, rather than higher rates of photosynthesis, give exotic plants a competitive edge.

Plant Ecology

- P108 BAIRD¹, RICHARD, CLARENCE WATSON², AND SANDRA WOOLFOLK¹. Entomology and Plant Pathology Department, Box 9655¹, MAFES Administration, Box 9740², Mississippi State University, Mississippi State, MS 39762—Microfungi from bark of healthy and damaged American beech, Fraser fir, and Eastern hemlock trees during an All Taxa Biodiversity Inventory in forests of Great Smoky Mountains National Park.

The assemblage of microfungi associated with bark samples of healthy and damaged American beech, Fraser fir, and Eastern hemlock trees was evaluated during an All Taxa Biodiversity Inventory of Great Smoky Mountains National Park (GSMPN) in 2003 and 2004. Bark samples were collected from sampling points 0.3, 0.6, 0.9 and 1.2 m above the ground surface on the bole of each replicate tree. Patterns of species composition and diversity (species richness) were evaluated from the bark samples over three sampling dates (May, July, and September) per year. A total of 4,814 isolates were obtained over the two years with greater than 95% belonging to the Fungi Imperfecti. Over 94 species of fungi were identified from bark of the three tree species with damaged ones under pressure from exotic pests. The most common fungal genus was *Trichoderma* for which a total of 13 species were identified during the two-year study. Frequencies of microfungi between healthy and damaged trees were similar across years, but when data was compared by year, frequencies were significantly greater in 2004 than 2003. Species richness was almost always significantly greater in September than in May and July. Frequencies of microfungi isolated from bark samples collected 1.2 m above the ground were significantly greater than in samples collected at 0.9, 0.6 and 0.3 m. It is believed that increased species richness at the higher bole positions was related to changes in microenvironment as proposed by previous researchers. All other comparisons of species richness were similar during the two-year study in GSMPN.

- P109 BARONE, JOHN A.¹ AND JOVONN G. HILL.² Columbus State University¹ and Mississippi State University²—Floristic affinities of black land prairies in Mississippi and Alabama.

Over 140,000 hectares of black land prairie were present in the Black Belt region of Mississippi and Alabama in the early 19th century. An additional 20,000 hectares were present in the Jackson Belt in central Mississippi. We surveyed the grasses and forbs from remaining prairie fragments in both regions to determine the floristic affinities of these prairie regions. Of the approximately 175 species in our sample, about 40% have widespread distributions and are present throughout much of the continental United States. About 10% of the species have distributions confined to the Southeast and Midwest. Five species (or subspecies), such as *Neptunia lutea* (Fabaceae) and *Bouteloua curtipendula* (Poaceae), appear to have disjunct distributions, with populations in these prairie belts, isolated from additional populations located primarily to the west. Such disjunct distributions are consistent with the hypothesis that these black land prairies may once have served as refugia for prairie species during periods of glaciation.

- P110 BELOTE, R. T.¹, SHARON M. HOOD^{2,5}, BRYAN WENDER^{3,5}, BOB JONES¹, CAROLA HAAS⁴, TOM FOX⁵, SHED ZEDAKER⁵, AND DAVID SMITH⁵. Virginia Tech—Disturbance intensity determines the relationship between native and non-native species diversity in the Southern Appalachian Mountains.

Ecological theory and small scale experiments predict that increased diversity of resident plant species will resist colonization of new, potentially invasive plant species. However, recent observational data suggest that native species richness is positively correlated with

non-native richness, implying that "hotspots" of native diversity may be prone to invasions by non-native plant species. This positive correlation, however, may not be ecologically meaningful, because null models predict the same pattern. Alternative hypotheses that may better explain observed patterns predict that invasive plant success depends on disturbance and resource availability. We used data from an ongoing study in the Southern Appalachian Mountains to assess the relationship between richness of native and non-native understory plant species across a disturbance gradient. Seven silvicultural disturbance treatments, representing alternative management practices, were applied at seven oak-dominated forested sites in West Virginia and Virginia. The relationship between native and non-native plant species richness was investigated using pre-disturbance and post-disturbance data. Prior to disturbance there was no relationship between native and non-native plant species richness. However, there was a positive linear relationship between native and non-native plant species richness after the disturbance gradient was initiated. This pattern is caused by the increase in both native and non-native understory species richness with increasing colonization rates across the disturbance gradient. We plan to continue to monitor these plots, but these initial results suggest that (1) the relationship between native and non-native richness depends on disturbance and (2) silvicultural disturbance initially increases the number of native and non-native plant species in the Southern Appalachian Mountains.

P111 CHAPMAN, WILLIAM¹, KERSTING, SHANE¹, BECK, JENNIFER², AND DANNY J. GUSTAFSON¹. The Citadel¹ and College of Charleston²—Is the grass greener on the other side of the road? Characterizing primary producers, primary and secondary consumers in two marshes separated by an earthen causeway.

Edisto Beach, SC, is a small front barrier island that is separated from Edisto Island, SC, by Scott Creek. In 1939, an earthen causeway was built to facilitate development of Edisto Beach west of the causeway, while Edisto Beach State Park has limited development to the east. In this study, we characterized the salt marsh plant and animal communities in the less developed eastern marsh and more developed west marsh in order to determine 1) if these communities are different and 2) if these differences can be associated with surrounding land / water use actives. We measured primary production (*Spartina alterniflora*), primary (*Littoraria irrorata*) and secondary consumers (terrapins and bluecrabs collected in crab pots and fish collected in minnow traps) in May 2005. There were significant differences in between the east and west marshes and these differences were evident across three trophic levels. The least developed east marsh had greater primary production, fewer grazing *L. irrorata*, more bluecrabs and terrapins than the west marsh. In the west marsh, *L. irrorata* population structure was shifted towards larger animals, which was associated with greater radula damage to *S. alterniflora*. The west marsh did, however, have higher fish species richness (n=6) than the east (n=2), but these 4 additional species accounted for 7 out of the 71 animals sampled. The salt marsh communities are different between these two marshes, separated for ~ 65 years, and these differences appear to effect multiple trophic level interactions.

P112 FORTNER, A. RENEE AND MAYA E. GOKLANY. University of North Carolina at Asheville—Photosynthetic responses of the invasive exotic, *Miscanthus sinensis* Andersson, to variable light environments.

Miscanthus sinensis Andersss. is a C₄ grass that has spread throughout open, disturbed habitats in the Eastern United States. The focus of this study was to characterize the photosynthetic responses of *M. sinensis* to a variable light environment, and to assess its ability to utilize low light and sun flecks. Plants were sampled along two natural and one artificial light gradients (ranging from 5% to 100% of full sunlight) on the Biltmore Estate in Asheville, North Carolina. Photosynthetic rates in all plants (grown in both high and low light levels) were high and most plants did not become light saturated at full sunlight (2000 $\mu\text{mol m}^{-2} \text{s}^{-1}$). Photosynthetic quantum yield was higher in plants growing in lower light. Specific leaf mass and dark respiration rates decreased slightly in plants growing in lower light, resulting in lower light compensation points. There was no shift in the chlorophyll a:b ratio in any of the plants. Upon exposure to high light, *M. sinensis* growing in higher light

induced more quickly (4 – 5 minutes to 50% maximum) than shade plants (6 – 8 minutes to 50% maximum). Plants growing in lower light had slower stomatal opening (22 – 23 minutes to 90% maximum) compared to plants growing in higher light (18 – 19 minutes to 90% maximum). All plants along the light gradient had similar rates of induction loss (< 10 minutes to 50% induction loss). Our results indicate that the C₄ pathway potentially limits *M. sinensis* to high light environments.

- P113 HESS, MATT AND JONATHAN EVANS. University of the South—The effect of an introduced ambrosia beetle (*Xyleborus glabratus*) on red bay (*Persea borbonia*) mortality in maritime forest communities of St. Catherine's Island, GA.

Over the past two years, red bay (*Persea borbonia*, Lauraceae) populations along the Georgia coast have experienced high levels of mortality due to an introduced fungal pathogen (*Ophiostoma* sp.) being spread by outbreaks of a recently introduced, Asian ambrosia beetle, *Xyleborus glabratus*. The beetle carrying the fungus was believed to have arrived in this country on shipping pallets and was first identified in the port of Savannah, Georgia in 2002. Red bay is an abundant and ecologically important tree species found in the coastal plain of the southeastern United States. This study represents the first assessment of red bay decline, which as a casualty of an introduced pathogen, may be following the same fate as American chestnut, American elm and flowering dogwood in the forests of the eastern U.S. Five 5000m² plots were established on St. Catherine's Island, a barrier island south of Savannah. The status of red bay populations in these plots was assessed in 2004 and 2005. We found that there was a significant increase in the number of infected red bays from 2004 to 2005 and that tree size was not correlated with infection. The density of infected red bays increased from south to north (portion closest to Savannah) within the island. In addition, we found that infected red bays were more likely to produce basal sprouts than uninfected red bays. However, potential regeneration by basal sprouts was severely limited by deer browse. The ecological implications of red bay decline in coastal forests will be discussed.

- P114 HOCHSTEDLER, WENDY W.¹, DAVID L. GORCHOV¹ AND BRADFORD S. SLAUGHTER². Miami University¹ and Michigan Natural Features Inventory²—The effects of June precipitation on *Alliaria petiolata* (garlic mustard) growth and survival in southwestern Ohio.

The factors that determine population dynamics of invasive plant species are not well studied. *Alliaria petiolata* (garlic mustard), an invasive biennial with a seedbank, exhibits annual fluctuation in juvenile (rosette) and adult density. We found June precipitation to correlate with juvenile *A. petiolata* density in October and adult density the following May (2000-2004) in Hueston Woods State Park, Preble Co., OH. Since ability to predict density would facilitate management of this invasive species, we experimentally tested the impact of precipitation on *A. petiolata* density. We excluded rain in June 2005 from 36 0.8 x 0.8 m plots in a second-growth maple-dominated stand in southwest Ohio. We trenched and lined plots to a depth of 20cm, and randomly assigned 12 each to receive low (1 cm), medium (10 cm) and high (20 cm) water treatments. In central 0.25 m² plots we assessed soil moisture, *A. petiolata* rosette root depth, root and shoot biomass, and survival through Oct. 2005. We will also determine *A. petiolata* survival and adult size in spring 2006. Soil moisture content, measured with a time domain reflectometer, was significantly affected by treatment. However, *A. petiolata* biomass, root length, and survival did not differ among treatments. Given the findings of this short-term water manipulation, June precipitation is probably not a reliable predictor of *A. petiolata* rosette survival, and explanation for supra-annual variation in *A. petiolata* density likely lies elsewhere.

- P115 ISBELL, JASON T. AND LORETTA L. BATTAGLIA. Southern Illinois University Carbondale—Does the invasive autumn olive alter community composition and fire characteristics in upland hardwood forests of southern Illinois?

Invasive species are a major threat to the structure and function of native plant communities, particularly when natural disturbance regimes have been altered. Fire is one disturbance that can affect, and be affected by, invasive species. It is imperative that we

understand how fire disturbance, invasive species, and native plant communities interact given the ever increasing numbers of invasive species, as well as the large amount of land where fire has been excluded due to fire suppression policies. When the frequency and intensity of natural disturbances are modified, an invasive species may be able to establish and form a new disturbance regime determined by the characteristics of that species. Autumn olive (*Elaeagnus umbellata*) is one such invasive species in Southern Illinois that may be able to affect fire characteristics, and thus the surrounding plant community. We completed an inventory of autumn olive at Crab Orchard National Wildlife Refuge in 2004 and found that this species is highly abundant and appears to be in an advanced stage of invasion, which may be related to its history of introduction and mode of dispersal. Our future research will focus on how the native community responds to prescribed fire in the presence and absence of autumn olive, how autumn olive responds to prescribed fire, and how characteristics of prescribed fires are affected by autumn olive. This work will expand theory on the ecology of invasive species, but it will also have implications for managers seeking to control invasive shrubs in upland hardwood forests.

P116 LONG, SAVOUN, PAULA JACKSON AND THOMAS MCELROY. Kennesaw State University—DNA sequence library of the trnL intron of several tree species from the Yucatan Peninsula, Mexico.

The result of rapid urbanization in Mexico poses a potential threat to the tropical deciduous forest of the Yucatan Peninsula by rendering ecological changes; therefore, it is essential to protect the availability of fresh water in that area. However, there is a lack of knowledge on how these dry tropical trees obtain their water sources due to the lack of research in the Yucatan Peninsula; hence, it is important to investigate the patterns of water acquisition in these areas, which will enhance further understanding on how to conserve these areas. The goal of this study is to create a DNA sequence library for tropical deciduous tree species from the Yucatan Peninsula of Mexico, which will help delineate differences in source water use among local tree species. The DNA from the plant leaf tissue was extracted with CTAB buffer, and followed the Qiagen Plant DNA Extraction Kit protocol. Agarose gel electrophoresis was used to detect if the DNA extraction was successful. Polymerase chain reaction (PCR) was used to amplify chloroplast trnL (UAA) intron for sequencing. Following PCR amplification, the PCR product was sequenced on an ABI 310 Genetic Analyzer. The DNA sequences from the plant tissue samples were submitted to GenBank and recorded in the local sequence database.

P117 MARTEN, EMILY J. AND LORETTA L. BATTAGLIA. Southern Illinois University—Prairie on the rocks: *Poa compressa* invasion of dolomite prairie pavements necessitates expansion of the driver/passenger model.

The driver/passenger model of species invasion suggests that some invasive species (drivers) dominate through active competition with natives while other invasive (passengers) dominate due to their ability to tolerate stress over natives. Introduction of a species representing a functional type naturally absent from a system could have a major impact on community and ecosystem characteristics by ameliorating abiotic conditions and facilitating establishment of other species. The globally-imperiled dolomite prairie is characterized by shallow soils derived from the dolomitic limestone bedrock, leading to extreme changes in moisture content. Where the bedrock is completely exposed, a unique assemblage of plants ranging from obligate wetland species such as *Isoetes butleri* to desert species such as *Opuntia humifusa* occurs. We are conducting research on five pavements at Midewin National Tallgrass Prairie in Will County, Illinois. We have found that *Poa compressa*, a C₃ rhizomatous grass not native to North America, was a common invader of pavement assemblages. We suggest that introduction of this novel functional type may facilitate colonization by other species into the pavement communities and exposed dolomite areas, thereby closing open habitat. We predict that *Poa compressa* will fit the passenger model, but because it is a species capable of altering ecosystem characteristics it should be considered a driver of ecosystem change. The

driver/passenger model does not include this additional scenario, and we therefore propose an expansion of the current model.

- P118 MASON, JILLIAN, A. RACHEL PRAKASH AND HEATHER SUTTON. Kennesaw State University—Interspecific associations and physical factors influencing a growing population of *Cypripedium acaule*.

Cypripedium acaule, which is commonly known as the pink lady's slipper, is an orchid that grows in pine forests in northern Georgia, which represents the southern limit of its range. Kennesaw State University is fortunate to have a growing population of these plants in a remnant patch of forest. In 2004, a long-term study was initiated to track population dynamics of this orchid. Data is being collected yearly on the emergence of leaves and blooming dates, as well as the location of each plant. Students contributing to this ongoing research also complete an individual short-term project each year. In 2004, physical factors such as soil temperature, leaf litter depth, light intensity, and soil compaction were measured in areas both with and without pink lady's slippers. Only litter depth was correlated with the presence of pink lady's slippers. This year's project investigated the associations pink lady's slippers have with other plants, including loblolly pine (*Pinus taeda*), poison ivy (*Toxicodendron radicans*), Japanese honeysuckle (*Lonicera japonica*), Virginia creeper (*Parthenocissus quinquefolia*), white oak (*Quercus alba*), grapevine (*Vitis sp.*) and greenbriar (*Smilax sp.*). Greenbriar and poison ivy were found to have negative associations with pink lady's slippers, while loblolly pine was found to have a positive association with the pink lady's slippers.

- P119 MICHOT, ALLEN III, RICKY FIORILLO AND CHRIS ADAMS. Shorter College—Over-wintering germination rate of two seed phenotypes of the Rough Cockleburr, *Xanthium strumarium*.

In August 2004, we collected fruits from a population of *Xanthium strumarium* found in a dry seasonal pond in Marshall Forest, Rome, GA. *Xanthium strumarium*, the common cocklebur, usually produces a fruit containing two phenotypically dimorphic seeds. We weighed 200 fruits then removed and weighed the seeds. Seeds from each fruit were separated according to size into a large or small phenotype group. For two months, 100 seeds of each phenotype group were subjected to a cold temperature treatment (over-wintering), while the remaining 100 seeds in each phenotype group were maintained at ambient temperature. Seeds from each temperature X phenotype treatment combination were assigned randomly to ten replicates and germinated on a moist sand substrate. After germination, seedlings were transplanted into commercial potting soil. We present data on germination and growth rate.

- P120 REID, LEIGHTON AND JONATHAN EVANS. University of the South—Nonequilibrium dynamics in a mature, oak-hickory forest on the southern Cumberland Plateau in TN.

Non-equilibrium theory of forest dynamics suggests that forest communities may never actually attain a steady-state (climax) pattern of community composition, structure and function over time. Instead, according to this theory, forest communities are constantly in the process of responding to the last disturbance event putting them on a constant and unpredictable trajectory of change. This theory may be particularly relevant to our contemporary understanding of Southern Appalachian forests which, over the last 100 years, have experienced the compounded effects of major anthropogenic influences including: fire suppression, deer overpopulation, introduced pathogens, timber harvesting, acid rain, etc. In this study, we examined 27 years (1978-2005) of change in a mature, oak-hickory forested watershed on the Cumberland Plateau in southeastern Tennessee. Specifically, we studied the spatial and temporal trends in size-class distributions of constituent tree species as a way of testing whether this forest is characterized by non-equilibrium dynamics. We found that during this time period no tree species could be characterized as having a stable size class distribution. All oak (*Quercus spp.*) and hickory (*Carya spp.*) species showed major declines in the density and distribution of saplings and subcanopy individuals, suggesting a future regeneration failure of these canopy

dominants. *Cornus florida*, the third most abundant understory species in 1978 showed a 95% decline in density within the forest over the 27 years. In contrast, red maple (*Acer rubrum*) has dramatically increased as a canopy species and has shifted in its spatial distribution within the watershed. Processes underlying these trends will be discussed.

- P121 RITCHIE, JERRY C.¹, GREGORY W. MCCARTY¹, ERIK R. VENTERIS² AND LLOYD B. OWENS³. USDA ARS HYDROLOGY AND REMOTE SENSING LABORATORY¹, OHIO DIVISION OF GEOLOGICAL SURVEY², AND USDA ARS NORTH APPALACHIAN EXPERIMENTAL WATERSHED³—Effects of landscape management on soil redistribution and soil organic carbon content.

Different landscape management strategies are used to minimize water, wind, and tillage erosion that tend to redistribute soil and soil organic carbon (SOC) across the landscape. This study used fallout Cesium-137 to determine rates and patterns of soil redistribution on 19 small first order single management watersheds at the USDA ARS North Appalachian Experimental Watershed (NAEW) at Coshocton, Ohio. These small watersheds have been managed and monitored since 1935. Management practices include conventional tillage with and without manure added, no-tillage with manure added, pasture with high and medium fertility levels, and natural meadows. Soil redistribution rates and SOC differed significantly between management practices with natural meadows having the lowest redistribution rates followed by pastures, no-tillage, and conventional tillage. Addition of manure significantly affected SOC content within a management practice. These studies show the impact of management on soil redistribution and SOC patterns within small watersheds and will aid in developing better management strategies to conserve soil resources.

- P122 ROBERTS, JOEY¹, COLLEEN IVERSEN² AND RICHARD NORBY³. Middle Tennessee State University¹, University of Tennessee² and Oak Ridge National Laboratory³—Disentangling sweetgum and understory fine-root response at ORNL FACE: an isotopic approach.

Experimental data have shown sweetgum (*Liquidambar styraciflua*) net primary productivity (NPP) at ORNL Free Air CO₂ Enrichment (FACE) facility has increased in response to elevated [CO₂], and much of the additional carbon fixed is now allocated belowground to the fine-root pool. Unfortunately, fine roots cannot be distinguished by species, adding to the uncertainty of individual plant responses to CO₂ enrichment. To determine whether the observed increase in belowground net primary productivity (BNPP) is a consequence of the composition of understory species we use the ¹³C signal of the C₄ grass, *Microstegium vimineum*, in the FACE rings to differentiate between understory and sweetgum (*L. styraciflua*) response to CO₂ enrichment. We further differentiate between Japanese honeysuckle (*Lonicera japonica*) and sweetgum due to the depleted ¹³C signature, characteristic of a closed canopy understory, utilized by the honeysuckle vine. We found that the fine roots of the three dominant species in the FACE experiment (*M. vimineum*, *L. styraciflua*, and *L. japonica*) show significantly different ¹³C ‰ values in both ambient (-15.63‰, -29.59‰, -32.00‰) and elevated (-25.48‰, -38.48‰, -42.02‰) plots, respectively. We used a three-member mixing model to quantify the contribution of each species to a volume of fine roots from a soil core. These data will be used to adjust C fluxes and quantitative estimates of fine-root production measured by minirhizotrons.

- P123 SUPER, PAUL E.¹, SALLY EDWARDS², LORA LINDLEY², MELISSA MCLEDDERRY², ROD NELSON², JOHN SHADWICK², KATIE WINSETT², FRED SPIEGEL² AND STEVE STEPHENSON². Appalachian Highlands Science Learning Center of the National Park Service¹ and University of Arkansas²—Surveys for mycetozoans in National Parks.

Surveys for mycetozoans (slime molds) are being carried out in a number of parks within the National Park System to document more completely the species associated with the various habitats present within each park. For many of these parks, there are no previous data on the slime molds present. The surveys encompass all three groups of slime molds (myxomycetes, dictyostelids and protostelids) and include both a field component

(collecting fruiting bodies of myxomycetes that have developed in nature) and laboratory studies (obtaining specimens of all three groups from samples of plant debris collected in the field and then used to prepare primary isolation cultures in the laboratory). Among the parks investigated within the past year are Shiloh National Military Park, Russell Cave National Monument, Cumberland Gap National Park, Hawaii Volcanoes National Park, Olympic National Park, Rocky Mountain National Park, Redwoods National and State Park and Tallgrass National Preserve.

- P124 SWEETSER, SUZANNE, C. SMOOT MAJOR AND KELLY MAJOR. University of South Alabama, Dept. of Biological Sciences, Mobile, AL—The abundance and distribution of invasive plants in southern Alabama: development of a predictive model for stemming the rate of spread.

The ultimate goal of this project is to develop a predictive model that will be of use to conservation biologists and land managers. Habitat, distributional and historical data will be used to identify native and protected habitats likely to be impacted by biological invasion and subsequent losses in biodiversity. Transect, block and route sampling techniques are being employed to gather information regarding plant community structure, habitat type, pathways of transport, as well as, the presence/absence and distribution of exotic and/or invasive plants across the coastal counties of Alabama. At present, we have collected preliminary floristic data that suggest several exotic species have established potentially viable populations along tributaries of the Mobile-Tensaw Delta, the Gulf of Mexico coastline and on islands in Mobile Bay. Such species include the highly invasive non-indigenous plants: *Alternanthera philoxeroides*, *Eichhornia crassipes*, *Hydrilla verticillata*, *Triadica sebifera*, *Imperata cylindrica*, *Lygodium japonicum* and *Myriophyllum spicata*, among others. Between February 2003 and August 2005, 4,700 records of occurrence data were compiled. Our most recent estimates indicate that 291 species of exotic plants have established themselves across the coastal plains of Alabama; new additions to the list include *Photinia vilosa*, *Ilex cornuta*, *Polygonum caespitosum* and *Paspalum dilatatum*. Furthermore, naturalized populations of gladiola and crepe myrtle have been found growing along both major and minor thoroughfares. Of the aforementioned 291 species, ca. 25% are known to be highly invasive and represent a genuine threat to natural areas, agriculture, sport fishing and tourism in the state of Alabama.

- P125 THORNHILL, ROBERT, DONNA WEAR AND JUDY GORDON. Augusta State University—Status of the shoals spider-lily *Hymenocallis coronaria* (Le Conte) Kunth on the Savannah River, Augusta, GA.

The shoals spider-lily, *Hymenocallis coronaria* (Le Conte) Kunth, is native to fall line reaches of river systems in Alabama, Georgia and South Carolina. This species is listed as endangered in the state of Georgia and is under consideration for federal protection. We compared the status of a population of *H. coronaria* downstream from Strom Thurmond Dam on the Savannah River, Augusta, GA, with that of a less impacted population on Steven's Creek, a tributary of the Savannah River, in Plum Branch, SC. Variables of interest were maximum flow rate, basal diameter of clumps, the number of seeds and seedlings present, and whether clumps of plants were submerged, partially submerged or emergent. Maximum flow rate was significantly greater in the Savannah River ($\bar{x}=9.98$ m/s) than on Steven's Creek ($\bar{x}=5.63$ m/s). Mean basal diameter of clumps did not differ between the two populations. There were more seeds observed in the population of lilies on the Savannah River (12) than in Steven's Creek (4). No seedlings were found in the population on the Savannah River whereas 29 seedlings were found in the population on Steven's Creek. Only 21% of clumps were above water (emergent) in the population on the Savannah River and all clumps were emergent in the population on Steven's Creek.

- P126 VERNIER, KIM¹, VINCENT HUSTAD¹, ANDREW S. METHVEN¹, SCOTT MEINERS¹, KAREN F. GAINES¹, AND ANDREW N. MILLER². Eastern Illinois University¹, Illinois Natural History Survey²—Macrofungi associated with tree windfall in old growth prairie groves.

This study is investigating macrofungi associated with tree windfall in Brownfield (26.1 ha) and Trelease Woods (24.5 ha), Champaign Co., Illinois. These woods are remnants of a larger, pre-settlement prairie grove and are now encircled by houses, fragmented forests, prairie and agricultural land. Although initially a virgin, deciduous upland forest dominated by oak, ash and maple with a high, closed canopy and fairly open (Brownfield Woods) to moderately dense (Trelease Woods) understory, sugar maple is rapidly becoming the dominant tree species. Beginning with a windstorm in November 1994 that damaged canopy trees in Trelease Woods, fallen trees in both woods have been tagged with an ID number, date of windfall, dbh and location relative to a network of marked grids. Wood-inhabiting macrofungi are being surveyed from 150-200 fallen trees with tree species, dbh, decay class and bark condition being recorded. Terrestrial macrofungi are being surveyed along twenty, 100 m long transects. Among the questions to be answered are: i) How does macrofungi species composition change on woody substrates of different species, dbh, decay class and bark condition? ii) How does macrofungi production vary within and between years?; iii) How does macrofungi species composition and species richness change within and between years?; iv) How do tree windfalls perturb macrofungi species composition and richness patterns?; and, v) Are parameters that influence macrofungi species composition spatially autocorrelated?

- P127 VICK, JOSEPH S. AND CHRISTOPHER A. ADAMS. Shorter College—Vegetation analysis of a bottomland hardwood forest along the Coosa River in the Ridge and Valley Physiographic Province of northwest Georgia.

This research examined the vegetative composition of a recently logged bottomland forest along the Coosa River located in Rome, Georgia. This study was conducted during summer 2004 (May – July). The sampling method used was circular plot analysis. This method used quadrat circles measurements broken into three major radii dealing with vegetative type (herbaceous or woody) or trunk diameter. Line transects 100m long were placed in the study area. Flags were placed every 20m to represent the centers of the plot circles. There were five plot circles with three quadrats each per transect. Sampled vegetation within these radii included the *inner* circle (6 m diameter) - grasses, forbs, and low lying woody saplings, the *middle* circle (12m diameter) -moderately sized shrubs and young tree saplings, and the *outer* circle (22m diameter) - mature trees over 8 cm in diameter. The data will be used to determine the percent composition, importance value, and species richness of vegetative within the study area. This will provide insight into forest recovery and composition following disturbance.

- P128 WARREN II, ROBERT J. University of Georgia—Demographic response of two understory evergreen herbs along environmental gradients.

Despite many studies demonstrating spatial and temporal variability in the growth, survival and reproduction of plants, few field studies have linked demography directly to spatial or temporal gradients in physical variables. I looked at growth, survival and fecundity in two evergreen herbaceous species (*Hexastylis arifolia* and *Hepatica nobilis*) as measured in a five-year field demography experiment by the H.R. Pulliam lab. The objectives were to determine (1) if abiotic variables such as light availability and soil moisture could explain the vital aspects of demographic performance, (2) if the plants responded to intermediate or increasing resource levels and (3) if demographic responses were temporal as well as spatial. The plants were monitored in demographic grids located along a geographic gradient from the southwestern North Carolina mountains to the northern Piedmont of Georgia. Each study grid was divided into 2 x 2 m grid cells and all individuals were located, marked and measured each year since spring 2000. Physical monitoring was done in cells uniformly distributed within each grid. Regression models indicated that light and soil moisture explained a great deal of evergreen demography, including presence,

growth, reproduction, leaf size and density. Maximum plant abundance and performance was at intermediate resource levels rather than at the highest ends of the environmental gradient; and *H. nobilis* and *H. arifolia* inhabited different abiotic niches. The relationship and importance of light versus moisture also changed with season.

- P129 WILSON, KELLY¹, KARTIKEYA SINGH¹, SOLIMAR MARRERO², EVA DÁVILA² AND JOE POLLARD¹. Furman University¹ and Universidad Metropolitana²—Storage and movement of nickel in ultramafic ecosystems of North Carolina and Puerto Rico.

The vegetation growing on soil derived from ultramafic rocks like olivine and serpentine is often stunted in growth, with many unusual or endemic plant species. Ultramafic soils have unusual physico-chemical properties, including high concentrations of nickel, cobalt, chromium, and magnesium. The goal of this study was to examine the storage of and movement of nickel in the abiotic and biotic compartments of such ecosystems, with emphasis on potential effects of leaf fall from woody plants on nickel cycling. Soil, water, and leaf samples were collected from three ultramafic sites, chosen because of contrasting patterns of leaf fall: Buck Creek, North Carolina (winter deciduous); Susúa, Puerto Rico (dry tropical, deciduous); and Maricao, Puerto Rico (humid tropical, evergreen). Initial results from Buck Creek indicate that trees in the Lauraceae and Magnoliaceae store unusually high levels of nickel in their leaves (100-200 ppm), while conifers accumulate very little (6 ppm). Average nickel uptake by all plants tested at the three sites was: Buck Creek , 11.3 ppm; Susúa, 25.0 ppm; and Maricao, 34.8 ppm. Two previously unidentified strong accumulators of nickel were found at Susúa, with nickel concentration in excess of 100 ppm, but no hyperaccumulators of nickel (>1000 ppm) have been found at any of the sites.

- P130 LUKEN, JAMES, JOHN HUTCHENS AND KEITH WALTERS. Coastal Carolina University—Long-term vegetation change in the high marsh near Hog Inlet, South Carolina.

Long-term changes in high salt marshes are relatively unstudied. The lack of long-term data is surprising considering the potential of these plant communities to be modified by development in the adjacent uplands. A grid of permanent 1 m² plots was established in the high marsh near Hog Inlet, South Carolina. Plots were initially sampled in 1998 and were resampled in 2002 and in 2004. The goals of this project were to establish rates of community change in a relatively undisturbed high marsh system (i.e., reference conditions), to identify dominant plant community types, and to characterize environmental factors that contribute to community variation in the high marsh. Non-Metric Dimensional Scaling and clustering techniques were used to identify plots with similar plant communities. Ten plant species were encountered among 66 plots. Species with highest frequencies included *Borrichia frutescens* (76%), *Limonium carolinianum* (61%), *Spartina patens* (47%), and *Distichlis spicata* (45%). *Spartina alterniflora* occurred in only 9% of the plots. Three different communities dominated by a single species were identified. The dominant species of these communities were *Spartina patens*, *Salicornia virginica*, and *Juncus roemerianus*. Preliminary data analyses suggest that the less diverse communities (i.e., monospecific patches) are remarkably stable through time while more diverse communities show changes in species importance. Results of this research are being integrated into an assessment of how development of the marsh shoreline may lead to changes in the high marsh system.

- P131 SCARBOROUGH, ANGELA R. Central Missouri State University—Tree canopy myxomycetes: patterns of distribution

Myxomycetes have been classified in the Kingdoms Animalia, Plantae, Fungi, and Protista, with molecular evidence favoring the Protista. Known as true slime molds because of their plasmodial stage, myxomycetes produce small, spore-forming fruiting bodies which often go undetected in tree canopies. Resting stages (spores, microcysts, and sclerotia) enable corticolous myxomycetes to grow on the bark surface of living trees and vines. The objectives were to tabulate the frequency distribution of canopy

myxomycetes along a vertical transect up to 12 meters; to quantify and compare the presence or absence of canopy myxomycetes with those previously found on ground sites; to search for new and rare myxomycete species; to determine if any myxomycete species are restricted to canopy heights above 3 meters. The working hypothesis states that no myxomycete species are restricted to the upper canopy since none are presently known based on the estimated 1000 species recorded worldwide. Bark samples were collected from living tree canopies in Great Smoky Mountains National Park, Tennessee and Perle Springs, Missouri using the double rope climbing technique. Bark samples collected from *Juniperus virginiana*, *Picea rubens*, and *Quercus alba* were placed in moist chamber cultures where plasmodia and fruiting bodies were observed and identified microscopically. A total of 54 myxomycete taxa were identified for both GSMNP (two new records) and PS (34 new records), including seven rare species (*Clastoderma microcarpum*, *Diachea arboricola*, *Echinostelium coelocephalum*, *Licea inconspicua*, *Macbrideola declinata*, and *Physarum synsporum*). *Diachea arboricola* is a new myxomycete species restricted only to the upper tree canopy.

Plant Systematics

P132 DIAMOND, ALVIN AND MICHAEL WOODS. Troy University—Gymnosperms of southeast and southcentral Alabama.

This treatment includes all taxa of gymnosperms native or established and reproducing in southeast and southcentral Alabama. This area includes Barbour, Butler, Coffee, Conecuh, Covington, Crenshaw, Dale, Escambia, Geneva, Henry, Houston, and Pike counties. The dichotomous keys and description are based upon material deposited in the herbarium of Troy University (TROY). Distribution records are based upon specimens deposited in the Troy University Herbarium (TROY), Auburn University Herbarium (AUA), and The University of Alabama Herbarium (UNA). Additional distribution records were obtained from the literature. Keys and county distribution maps are presented for the five genera, 12 specific and four infraspecific taxa. *Pinus*, the only genus of the Pinaceae represented in the study area, consists of eight specific and one infraspecific taxa. All nine taxa are placed in the subgenus *Pinus*, Section *Trifoliis*, Subsection *Australes*. Only one species, *P. virginiana* Miller, is non-native to the study area although it is native from central Alabama northwards. The family Cupressaceae is comprised of four genera. *Taxodium* and *Juniperus* are each represented by two taxa and *Chamaecyparis* and *Cunninghamia* are each represented by a single taxon. All members of this family are native to the study area except for *Cunninghamia lanceolata* (Lambert) Hooker, which is native to SE Asia.

P133 HUSTAD, VINCENT AND ANDREW S. METHVEN. Eastern Illinois University—Coprophilous species of *Coprinus* in east-central Illinois.

Although the genus *Coprinus* (Basidiomycota; Agaricales; Psathyrellaceae) is widely distributed world-wide, relatively little is known about the distribution of coprophilous species of *Coprinus* in North America. The purpose of this study was to inventory species of *Coprinus* that occur on domesticated horse (*Equus caballus*) dung in east-central Illinois. Samples of dung were collected beginning Spring 2005 and incubated in moist chambers to induce the production of *Coprinus* basidiomata. After maturation, basidiomata were removed from the dung, dehydrated and identified using macro- and micromorphological characteristics. A list of coprophilous species of *Coprinus* will be compiled and keys to the coprophilous species of *Coprinus* in east-central Illinois will be produced. Species descriptions and identities of *Coprinus* obtained in this study will be compared with known species from other regions in North America as well as Europe. Because coprophilous fungi are widely distributed but understudied, this research will provide important information on species richness and distribution as well as culture conditions for producing *Coprinus* basidiomata in a laboratory environment.

- P134 HUSTAD, VINCENT¹, ANDREW N. MILLER², AND ANDREW S. METHVEN¹. Eastern Illinois University¹, Illinois Natural History Survey²—Coprophilous fungi of the Great Smoky Mountains National Park.

Coprophilous fungi are an important component of terrestrial ecosystems and are responsible for recycling many of the nutrients in animal feces. The purpose of this study was to inventory the coprophilous fungi that occur on elk (*Cervus americanus*) dung as part of the All Taxa Biodiversity Inventory currently taking place in the Great Smoky Mountains National Park (GSMNP). Samples of dung were collected from the GSMNP beginning in Spring 2005 and incubated in moist chambers to induce the production of ascomata and basidiomata. Ascomata and basidiomata were removed, identified, preserved and compared with a list of known species from the GSMNP. Numerous new species records from the GSMNP have been discovered. A list of coprophilous species will be compiled and keys to the coprophilous fungi on elk dung will be produced. Because coprophilous fungi are widely distributed but little-studied, this research will provide important information on species richness and distribution as well as culture conditions for producing ascomata and basidiomata in a laboratory environment.

- P135 PRIESTLEY, MARY P.¹, YOLANDE M. GOTTFRIED¹, JON EVANS¹, CAITLIN ELAM², AND GEORGE S. RAMSEUR¹. The University of the South¹ and North Carolina State University²—Preliminary floristic survey of the domain of Sewanee: the University of the South.

The results to date of an on-going floristic survey of the ca. 4000-ha Sewanee Domain, located on the western escarpment of the Cumberland Plateau in Franklin County, Tennessee, are described. The work, which will include floristic analyses, is scheduled for completion at the end of the 2006 growing season. The majority of the Domain is on the plateau surface, with the remainder located in coves that dissect the plateau. Several plant communities and microhabitats are found here. Sandstone underlies the plateau forest, which is dominated by a mixed upland hardwood forest. Bedrock in the coves is limestone, producing mesic, botanically diverse sites, including two old-growth forests. Other important habitat types include wetlands (bogs, reservoirs, and streams) and open or disturbed areas. So far, 753 taxa in 127 families and 433 genera have been identified, including eight species that are monitored by the Tennessee Division of Natural Heritage. Preliminary assessments indicate that more than 100 of these species have not yet been reported for Franklin County. This survey is intended to serve as a basis for further investigation into the natural heritage of the Domain and to provide information for land management decisions.

- P136 STROLE, PHILIP, SIERRA, ESTEBAN, AND DANNY J. GUSTAFSON. The Citadel - ISSR analysis of 'Sweetgrass' and two closely related species.

Muhlenbergia sericea (Michx.) P.M. Peterson (sweetgrass) is the perennial cespitose native grass that has been a valuable economic and cultural resource for many of the sweetgrass basket makers in the Carolinas. These sweetgrass basket makers are members of the Gullah/Geechee peoples, which are direct descendants of Africans brought to the United States during the slave trade. Sweetgrass baskets represent a connection to their past, while providing economic and cultural enrichment. The taxonomic status of sweetgrass as a species, in the eyes of some coastal states, is unresolved and this has implications as to the management of this species and its natural community. Sweetgrass grows in sandy maritime habitats along barrier islands and coastal woodlands in the southeastern and gulf states. Two closely related species (*M. capillaris* and *M. expansa*) have somewhat overlapping ranges and all three were considered subspecies of single species one time. Systematics studies based on anatomical and floral structures shows these three taxa to be separate species. In this study, we use intersimple sequence repeats (ISSR) markers to test the hypothesis that these are three different species. Six primers and 25 alleles were resolved for representatives of all three species. While there

were some similarities in the genetic profiles, as one would expect for closely related species, *M. sericea*, *M. capillaris*, and *M. expansa* were genetically distinct taxa. Our genetic data supports the morphological research designating *M. sericea*, *M. capillaris*, and *M. expansa* as three species.

- P137 WOLF, HALEY, SELENE NIKAIDO AND JAY RAVEILL. Central Missouri State University—The genetic impact of an invasive species on a common native species, the hybridization of *Morus rubra* and *Morus alba* (Moraceae).

Two centuries ago, the Asian white mulberry (*Morus alba*) was introduced to populations of its North American relative, the red mulberry (*M. rubra*). Difficulty in identifying mulberry morphologically suggests that hybridization may occur, but evidence is limited. Interbreeding over generations may lead to the extinction of the parental species if the hybrids are more fit than their parental species. To examine the extent of hybridization, DNA sequence was analyzed. Seven mulberry individuals (two red, two white, and three morphologically intermediate) were haphazardly chosen from a wooded ravine near Warrensburg, Missouri. The internal transcribed spacer (ITS1) between 28S and 5.8S ribosomal DNA of each individual was analyzed from five clones of amplified DNA. Sequences of cloned DNA were compared to an *M. alba* reference sequence from GenBank. Aligned ITS1 sequences fell into two groups, each with a distinct sequence. Sequences of the group that included the *M. alba* sequence were classified as white mulberry. Sequences of the other group were classified as red mulberry. Although the majority of individuals had either white or red mulberry sequences, one individual had both red and white mulberry sequences and appears to be a hybrid. The other two morphologically intermediate individuals had red mulberry sequence. The morphologically identified red and white mulberry had sequences that matched their morphological designations. The findings of this research have documented that hybridization does occur between red and white mulberry. A more exhaustive study is underway to understand the genetic structure of this population.

- P138 WOODS, MICHAEL. Troy University—The genus *Desmodium* (Fabaceae) in Alabama.

Desmodium Desvaux, commonly known as tick trefoil, is a member of the legume family Fabaceae (Leguminosae), subfamily Papilionoideae, tribe Desmodieae, subtribe Desmodiinae. The Desmodieae are largely an Old World tribe, with *Desmodium* the largest genus, consisting of about 300 species. Forty-five species and seven infraspecific taxa of *Desmodium* have been reported from the United States. Of these, twenty-nine species and four infraspecific taxa have been reported from the southeastern United States. Based on the results of this study, twenty-three species and no infraspecific taxa of *Desmodium* are recognized as occurring in Alabama. Dichotomous keys and descriptions were generated based on morphological features of the vegetative and reproductive structures of the plants studied during the project. Data for the distribution maps was gathered from personal collections and plant specimens deposited in the herbaria of Troy University (TROY), Auburn University (AUA), The University of Alabama (UNA), The University of South Alabama (USAM), Jacksonville State University (JSU), University of North Alabama (UNAF), and Vanderbilt University (VDB), which is housed at the Botanical Institute of Texas (BRIT) in Fort Worth. Support for this project was provided through a Summer Research Grant from the Troy University Faculty Development Committee.

Teaching Biology

- P139 BRIGHT, S. KRISTEN, ZACK MURRELL, TERRY CARROLL AND RICHARD CARP. Appalachian State University—Application of ATBI protocols to faith-based facilities: a model for implementation.

The protocol for an ATBI (All Taxa Biotic Inventory) has been established on a large scale in the Great Smoky Mountains National Park. We have recognized a need to provide this type of information for areas that are smaller in size that would benefit from ATBI strategies of data collection and distribution in more local areas. Specifically, we have targeted faith-based facilities that have access to significant natural areas and desire to 1) appropriately steward these sites, and 2) provide ecological training in addition to more traditional religious training at the facility. Using the traditional and structured approach, as defined by current ATBI protocol, we have developed a methodology to implement an ATBI at Lutherock, owned by the Evangelical Lutheran Church of America (ELCA) and used as a summer camp for faith-based studies for all ages. The 900+ acre area has seven plant community types and currently over 350 documented species. Based upon our inventory efforts, we have been able to provide advice on development, use and conservation of the area. As we develop a protocol for this site, we have taken the opportunity to construct this in a general way that can be used by other similar facilities. We contend that faith-based facilities are an untapped resource for conservation and environmental education. Application of an ATBI protocol at faith-based sites promotes cross-talk between the scientific and faith-based communities and can provide an outlet to groups that have traditionally not been involved in conservation and stewardship efforts.

P140 STICE, ANDREW, JESSICA RUBINO, ASHLEY KORT, CHRISTOPHER BLANFORD, CHRISTIE BUCKINGHAM, ASHLEY DWYER, and REBECCA COBB. The Illinois College—Preparation of whole mammalian skeletons (*Canis latrans*, *Odocoileus virginianus*, *Procyon lotor*) for a biology museum.

Mammal carcasses from Morgan County, Illinois were frozen at – 20° C until processing could begin. The carcasses were then skinned, and most soft tissue was removed through gross dissection. The remaining flesh was removed by soaking in a hot aqueous solution of powdered bleach, L'oreal High Performance Quick Blue (Sally Beauty Supply). Periodically the bones were removed from the solution, and the connective tissue and muscle were scraped off. Cavities that were not readily accessible were cleaned with forceps, tweezers, and dental picks. The deer skull and the coyote and deer rib cages were placed in a large water trough of boiling Sal Soda (Wasco, INC). The bones soaked for 30 minute periods and were then removed for further cleaning. After all flesh was removed the bones were bleached white by soaking for 15-30 minutes with SalonCare Professional volume 40 crème developer (Sally Beauty Supply). With the help of veterinary anatomy texts and skeletons already in the museum, the bones were assembled in anatomically correct positions. The vertebral columns were strung along a pre-shaped iron rod and then mounted onto a board and metal stand. The remaining bones were articulated using 16-20 gauge copper wire and zap-a-gap (Wasco, INC) cyanoacrylic adhesive. The completed skeletons were then displayed in the Parker Science Center museum. With the cost of whole skeletons of mammals increasing beyond the budget of many teaching institutions, the local preparation of such skeletons is a viable and cost-effective alternative for the college or university museum.

The Southeastern Naturalist...

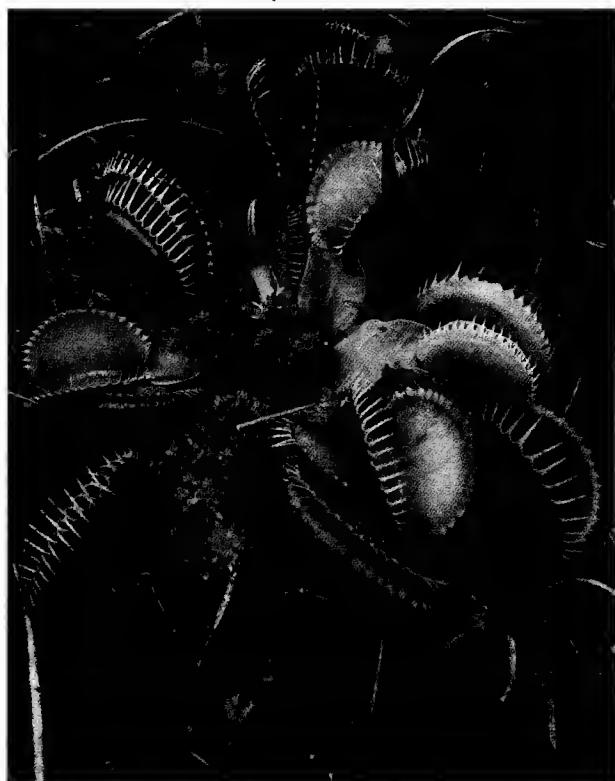
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Volume 4

2005

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BOOK REVIEWS

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Robinson, Peter J. 2005. **North Carolina Weather and Climate.** University of North Carolina Press, Chapel Hill, NC. 256 pages. \$39.95.

As they say in North Carolina, if you don't like the weather, just wait five minutes and it will be different. Peter Robinson's 236-page **North Carolina Weather and Climate** is an easy read of the subject in seven chapters: (1) weather in our lives, (2) sunshine, seasons and temperature, (3) water in the air and at the ground, (4) our common daily weather, (5) severe and hazardous weather, (6) weather around the state and through the year, and (7) forecasting the weather. Four appendices treat (a) getting information, (b) a practical guide to observing the weather, (c) climate data for selected stations, (d) twentieth-century hurricanes influencing North Carolina. An index follows on page 231.

This is a fabulous book. Robinson treats what is weather to what is climate and global warming. What do you use to indicate the severity of the forthcoming winter weather, wooly worms (p. 191)? I myself go by the number and date blackback gulls arrive at the coast. Nevertheless, what is weather is defined on p. 10; climate and meteorological forecasts (deterministic and probabilistic) are defined on page 17.

The earliest weather reporting occurred in 1820 (p. 19); the National Meteorological system wasn't established until 1900 (p. 21). How to express humidity is treated on page 56; how clouds (four types) form on page 62. Westerlies covering the latitude 30°N to 60°N have three components: (1) Rossby waves, (2) jet streams, and (3) the polar front (p. 91). Do you know what the Katabaric wind (p. 54), ocographic effect (p. 62), Rossby wave (p. 91-93), the Simpson-Saffis hurricane scale (p. 113), or the Fujita scale (p. 129) is?

The first named hurricane occurred in 1953, the first male named hurricane in 1979. A six-year rotating list contains names useable for future hurricanes (p. 119). Clear writing is interspersed throughout from the simple beginning to the complex aspects of climate and weather. I could find only one sentence (p. 16, last line) that didn't make sense. Vivid color figures, maps and boxes, profuse through the volume, are easy to interpret. The only disturbing aspect, through the volume, is the overuse of prepositions to begin sentences; prepositions make the sentence a prepositional phrase, not a sentence. The rainbow peeking out of the clouds, on the cover, is great. Robinson's book helps all ages understand what weather and climate are, its life and death (change) and how it affect us all. A must for your reading shelf.

FRANK J. SCHWARTZ, *Institute of Marine Science, University of Carolina, Morehead City, NC 28557-3209.* 

Fritsch, A. and K. Johannsen. 2004. Ecotourism in Appalachia: Marketing the Mountains. The University Press of Kentucky. Lexington, KY. 296 pp. \$35.00.

This is a well-documented and a well-written book on the tourism industry by two authors who are very much acquainted with world tourism. As stated on the back flap of the book jacket, Al (Albert J.) Fritsch is the founder of Appalachia-Science in the Public Interest (ASPI). He has authored several environmental books and reports. Kristin Johannsen is a freelance writer specializing in environmental issues and travel. While focusing on the Appalachian region, the book is composed of 10 chapters which trace the tourist industry from historic beginnings through to the development of tourism in selected parts of the world with a strong emphasis on Central Appalachia which encompasses the states of Kentucky, Tennessee, Virginia, West Virginia, and North Carolina.

The Introduction to the book presents an overview of present-day tourism and how it impacts the world economy. The authors state that "according to the World Travel and Tourism Council, tourism is now the world's largest industry creating 3.6 trillion dollars of economic activity (directly and indirectly) annually. One out of every 15 workers worldwide is employed in tourism, and tourism is the third largest household expenditure (after housing and food) in most industrialized nations." In view of this, tourism is quite extensive in the states of Central Appalachia, and the authors cite several examples. Therefore, the authors would like to see tourist travel go beyond the practice of many years ago of travel from just simply going to a facility and relaxing for a week or two to traveling to enjoy an area and learn about the natural environment by engaging in activities such as bird watching, forest hiking, snorkeling, etc. without too much damage to the environment, and, at the same time, benefit the local people financially. The word for such activity is ecotourism. There are many definitions for this word, but the authors prefer the one used by the International Ecotourism Society—"Ecotourism is responsible travel to natural areas that conserves the environment and improves the well-being of local people." And this is the main theme and message of this book.

In Chapter 1, the authors present a well-documented summary of the history of travel from Roman and Greek times to travel in Western Europe and North America in the eighteenth and nineteenth centuries and was limited by single horse or stage coach transportation. The introduction of railroads in 1830, and more extensive air and automobile travel after World War II greatly increased tourist travel to many areas of the world including the states of Central Appalachia. This situation is well-covered in Chapter 2. The mountains, rivers, and lakes (made by TVA) have been an attraction for hunting, fishing, water sports, hiking, camping, and other activities. Mention is made in this chapter and more extensively in Chapter 9 of the large popularity of the Blue Ridge Parkway, Great Smoky Mountains National Park, and the Cherokee Indian Reservation. Why is Central Appalachia so popular for tourism? Because it is within a day's vehicle drive over many interconnecting interstates from about half of USA households. GSMNP is the most visited national park in the USA at about 10,000,000 people per year. Another factor is that the tourist areas aim toward ecotourism and the local people are very friendly and very helpful to tourists in need of help for various reasons. Reports of aggressive mountain hermits are rare.

The authors also point to a downside to some aspects of tourism in Central Appalachia and other areas in the world. Some tourist attractions are owned by outside interests who arrange packaged tours. As a consequence, very few of the tourists' dollars go to the local people where the attraction is located, and then they have to deal with the trash and environmental damage left behind. The authors refer to this exit of dollars as "leakage." Environmental damage and pollution are well-discussed in Chapter 3 with the ATV problems in Central Appalachia, and how a change in attitude toward ecotourism in Chapter 4 can improve bad situations. Chapter 5 covers the rise and fall of tourism in Nepal and Belize as examples of what can happen in developing countries. Chapter 6 documents the problems for Hawaii and Alaska. Both of these latter chapters present lessons and warnings of similar problems for Appalachia. This aspect is further elaborated on in Chapters 7 and 8. As mentioned before, Chapter 9 describes the many positive practices of ecotourism in selected preserves of Central Appalachia including great financial benefit to the local people. Chapter 10 contains a wrap-up of the factors which make for excellent ecotourism. The last part of the book has an Appendix 1 containing a list of guidelines for responsible travel, an Appendix 2 of 99 recreational activities ranked by impact, and a section of notes with references for the introduction and for each of the 10 chapters followed by a very thorough index. The middle of the book contains 24 black and white photographs of various areas of tourism around the world. Some photographs were taken by the authors, and some by Kevin Millham.

This book is a "must read" for all who are involved with the tourist industry for developing good ecotourism practice, and for others who are interested in knowing about the largest industry in the world.

JAMES D. CAPONETTI, *Division of Biology, University of Tennessee, Knoxville, Tennessee 37996-0830.* *ca*



Cades Cove, Great Smoky Mountains National Park.
Photo by Marilyn Caponetti, Knoxville.

The NEON Project

Progress Report

For further information or to comment, contact:

Dan Johnson
Public Information Representative
NEON Project Office
(202) 628-1500, x215
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Planning for the National Ecological Observatory Network is beginning to yield new specifics about NEON science and the deployment of sensors and cyberinfrastructure.

NEON's ultimate goal is to forecast the future state of key ecological systems in the United States. When fully deployed, the observatory will function as a widely distributed national laboratory—a network of shared infrastructure for ecological research.

NEON will support systematic study of seven US ecological priorities: invasive species, infectious disease, climate change, land-use change, biogeochemical cycles, biodiversity, and aquatic ecosystems. A standardized set of sensor technologies and cyberinfrastructure will enable continuous, long-term data collection, storage, and dissemination.

NEON will deploy sensors and cyberinfrastructure within 20 distinct climatic domains across the continental United States (in addition to domains for Alaska/tundra/taiga, Hawaii/Pacific Tropical, and Atlantic Neotropical). The domain boundaries were determined using a cluster analysis of climate state variables, combined with air mass seasonality data. (See www.neoninc.org for more on the climatic domains and an interactive tool for exploring the maps.)

Within each domain (or NEON Node), infrastructure will be deployed in three land-use/land-cover types: wild, managed, and urbanized, each of which will contain transition zones between terrestrial and aquatic systems. Every NEON Node will feature a range of standardized instruments deployed at three fixed sites to provide critical data streams related to the ecological priorities, as well as mobile capacity to conduct routine manual sampling and to respond to sudden ecological events, such as the outbreak of an infectious disease.

NEON infrastructure will be networked via state-of-the-art communication and computational tools. It will include cutting-edge laboratory and field-based instrumentation enabling scientists to collect key biological, atmospheric, chemical, and physical measurements; site-based experimental infrastructure; bio-collections facilities and sample archives; and the computational, analytical, and modeling capabilities required for NEON forecasting.

NEON will be based on an open architecture that gives scientists access to new and evolving hardware and software technologies. A suite of NEON education programs will explicitly translate NEON science in ways that capture

the imagination and attention of the general public, including teachers, students, decision-makers, and citizens from all walks of life. Teachers will have real-time NEON data as a classroom learning resource, students and citizen-scientists will participate in field trips to collect data, and the general public will learn about their environment through daily ecological forecasts.

As NEON planning progresses, updated materials describing the project will be available in print and online. The NEON Preliminary Project Execution Plan—a document providing details about the costs, scheduling, and build-out of NEON instruments, facilities, and cyberinfrastructure—will be delivered in 2006.

CS

NEWS OF BIOLOGY IN THE SOUTHEAST

Leon Jernigan—News Editor
Department of Biology
University of North Carolina
Pembroke, NC 28372-1510

ABOUT PEOPLE AND PLACES

TENNESSEE

Drs. Gladys Alexandre, Assistant Professor, Department of Biochemistry, Molecular and Cellular Biology, and Igor Zhulin (Jouline), Associate Professor, Department of Microbiology, University of Tennessee, Knoxville, each presented an invited paper at the Gordon Research Conference on Sensory Transduction in Microorganisms held in Ventura, California, in January 2006.

This prestigious biennial conference had 125 participants from the United States, Canada, Japan, United Kingdom, France, Germany, Switzerland and Israel. It enabled researchers with diverse backgrounds and areas of expertise to discuss recent developments in environmental sensing and the control of movement in microorganisms, including bacteria, archaea, fungi, slime molds and protozoa. This conference has a legacy of driving rapid progress in emerging fields by bringing together researchers in a wide range of disciplines at all career stages.

For more information and the program listing presentations by Dr. Alexandre and Dr. Zhulin, please visit <http://www.grc.org/programs/2006/senstran.htm>.

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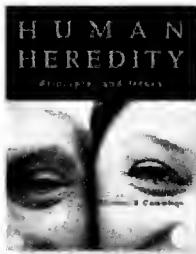
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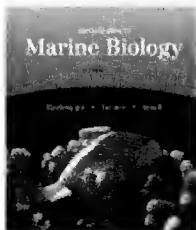
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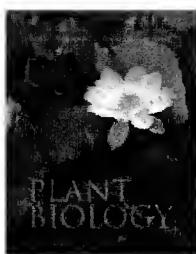
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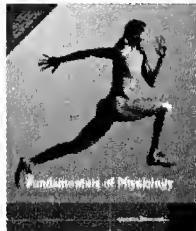
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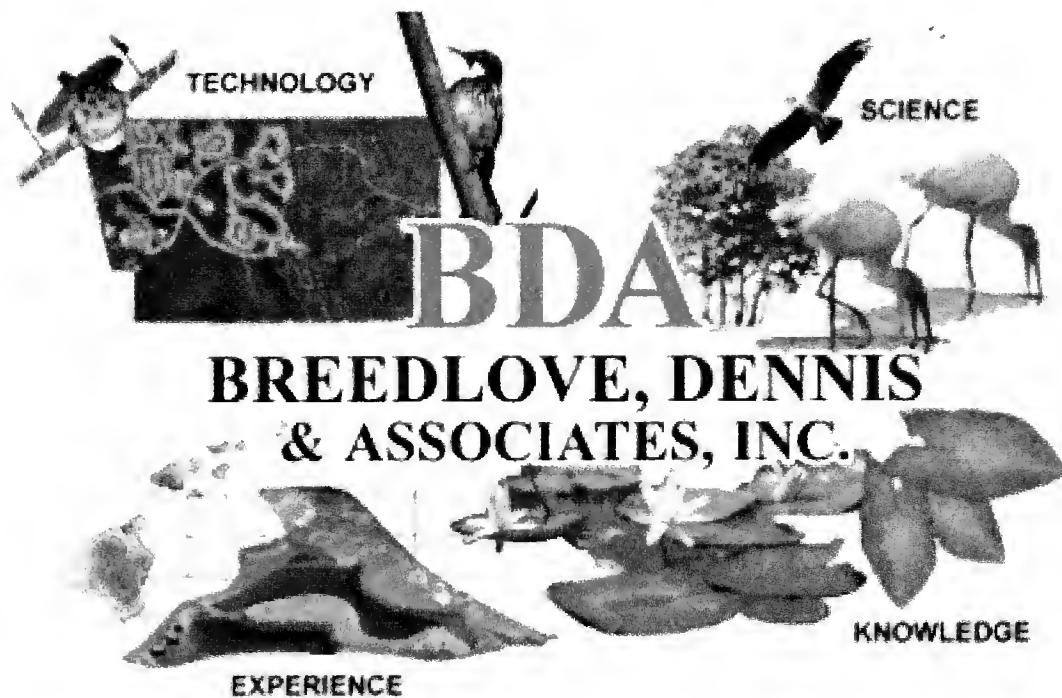
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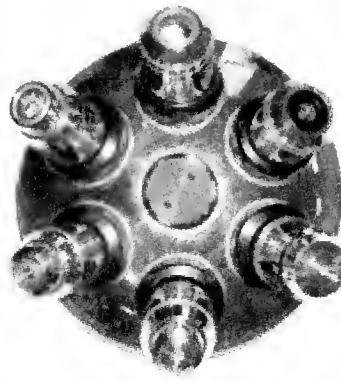
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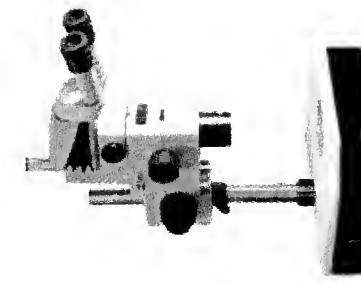
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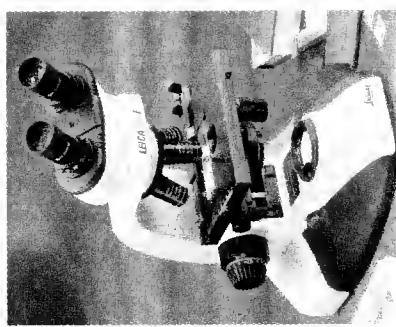
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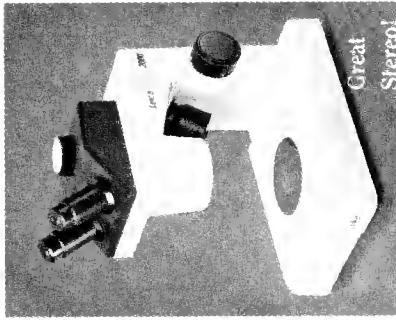
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